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Electrical World

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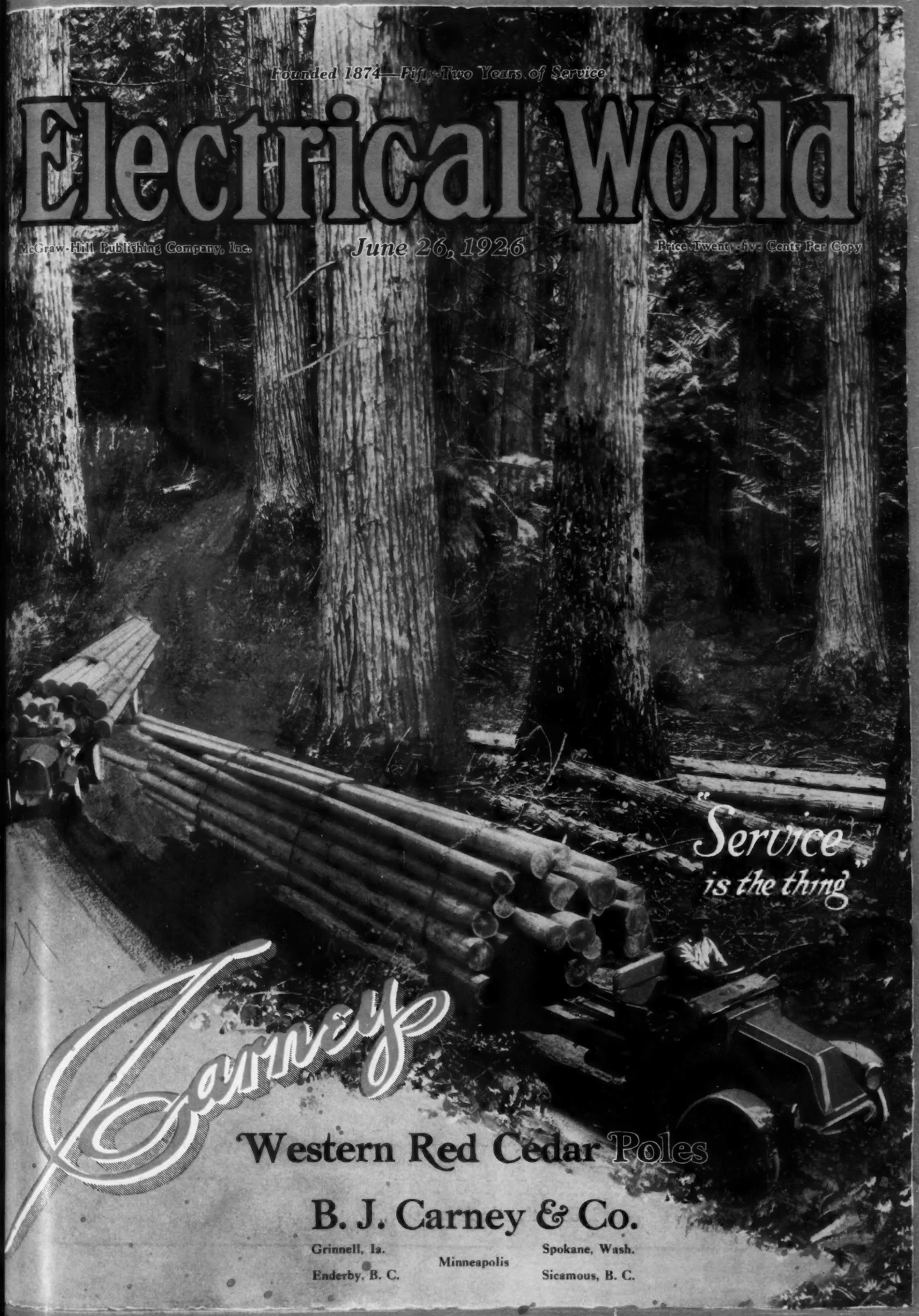

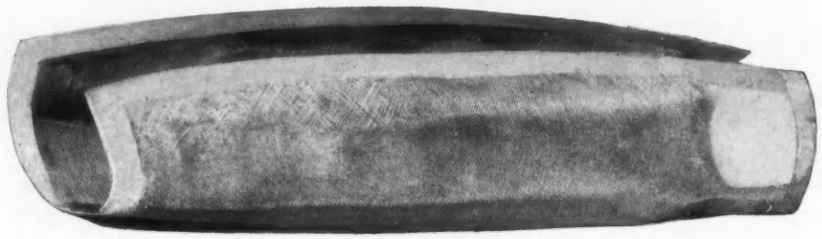

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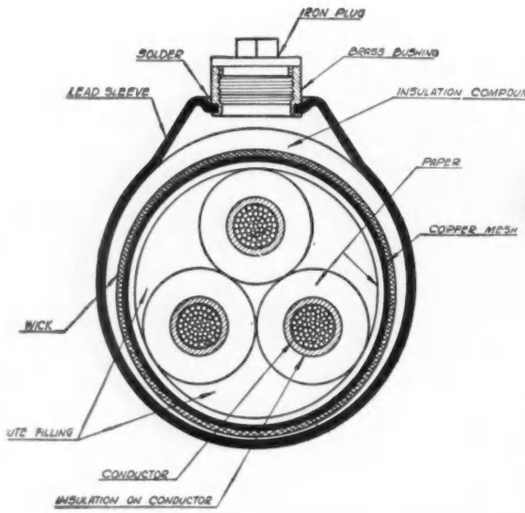

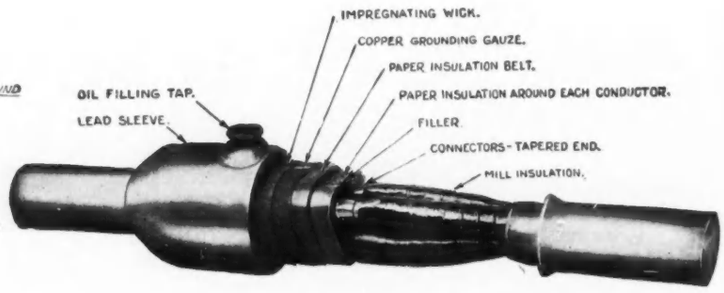

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Electrical World

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Putting Up a Front

SIDE streets and back alleys are never chosen by department or chain-store merchants as suitable locations for the profitable operation of their business. They recognize the value of putting up a front on the best and busiest street in town and are willing to pay the premium in higher rentals for the preferred positions. There are still some utility companies, however, that seem to believe that the location of their commercial offices makes little difference. Their places of business can be found—after persistent and diligent search—on the outer fringe of the business district, and the less said about the general appearance of these offices the better.

It does not speak well for a company which renders such important service to the public to make a shabby appearance or to emulate the shrinking violet in the location of its business office. The most important public relations are molded here, and ease of access, outward appearance, a cheerful atmosphere all influence the individual customer's mental attitude toward the utility. It is a sign of progress, therefore, to note the number of new office buildings which have been constructed by electric light and power companies in the last few years. Many others are under way or are being planned. Most of these have been located well within the business districts they serve, and while the real estate is somewhat more expensive, it nevertheless represents sound business policy and a profitable investment in better public relations.

How Shall New Business Be Defined?

MANY statistics are available which show the rapid increase in the number of consumers of electricity. For example, the number of residential customers in this country has been increasing at the rate of over 10 per cent per year. Commercial customers are increasing, at least in some sections, at the same rate. Other fields are also furnishing new consumers of electricity each year. This is a natural result of growth in population and the extension of electrical distribution. How much of this growth should be credited to the activities of commercial and new-business departments? Certainly, a large part of it is natural. This is one of the attractive features of the electrical business. It is bound to grow whether commercial departments do their full duty or not. This condition has doubtless tended to give undue credit to commercial departments and perhaps in many cases to blind them as to their real function.

Strictly new business might well be defined as the increase in consumption of electrical energy per consumer, other conditions remaining unchanged. For example, the average monthly consumption of residential consumers on the lines of the Ohio Public Service Company was 27.8 kw.-hr. in 1923 and 32.3 kw.-hr. in 1925. This is an increase of 16 per cent per residential customer over the two-year period. This 16 per cent is strictly new business because the average size of families and of homes remains virtually constant. Over the same two-year period the average monthly consumption per commercial customer increased about 6 per cent. Doubtless, this increase is strictly new business, although, of course, stores might have been enlarged. After making every reduction for natural growth, the results reaped by companies which are particularly active in lighting and other campaigns show an actual increase in strictly new business. It is the average consumption per meter, other conditions remaining unchanged, which properly appraises the new-business department.

Exchanging New Ideas Is the Basis of Progress

NO SMALL credit can be given to the practice of exchanging ideas as a factor in the phenomenal development of the central-station industry. Unlike some industries, where various units have kept their ideas unto themselves, the electric light and power industry has recognized that the maximum progress can be made by pooling ideas, and this has been exemplified by association and committee proceedings, periodical literature, personal conferences, etc. Very seldom does any selfish interest induce a company to withhold knowledge because it has spent time or money in developing or modifying a practice based upon it.

This pooling of experiences, ideas, etc., has even been found valuable in one industry the units of which are highly competitive. Once the units carefully guarded their ideas and practices, maintaining that they were their stock in trade and thinking that to divulge them would work to their detriment by benefiting competitors. Possibly because these units found that their supposedly secret ideas leaked out anyway through various channels, or because they finally recognized that pooling of ideas would bring the individuals several times the value of the ideas which they in turn contributed, a new order was established. The signs are that this industry has progressed more under this plan than it ever did under secret methods.

Of late light and power companies are giving more and more attention individually to employee-suggestion systems, some of which bring forth changes in practices or new methods that represent a large annual money saving. Some companies are pooling the results of these suggestions with their sister companies under the same management or financial control. Since many of these suggestions, even though dealing with details, are applicable nationally, directly or in modified form, they serve as additional material for industry exchange, provided that a system can be worked out whereby the exchange will work no hardship on the contributing

companies and provided that all companies demonstrate the same willingness to co-operate that is evidenced by the present exchange of ideas. To avoid a burden on any one, the widely applicable suggestions would have to clear through a single medium.

A number of executives have expressed an interest in such a further extension of present practice. Aside from its direct advantages, they recognize that it would serve as an additional stimulus to employee development, since it could give national recognition to individuals deserving it. By so doing it would encourage them to study the methods of others and thus round out their knowledge and appreciation of the utility business. In considering such a plan no company can afford to forget the experience of the competitive units of the industry just considered. The mechanism for handling the plan constitutes the chief problem of importance.

N.F.P.A. on Trial as Sponsor of the Code

ALL branches of the electrical industry have become deeply interested in the fortunes and misfortunes which have beset the new wiring material known as non-metallic sheath cable in its struggle for approval under the National Electrical Code. Since the application was made, more than three years ago, it has been the subject of heated controversy until the issue has become one not of the product but of the procedure which should be followed in the admission of newly developed materials for field trial and acceptance under the code.

In the beginning the single maker of the material was opposed by defenders of the code as it is, among whom were a number of manufacturers of competitive products. In the sub-committee of the electrical committee of the National Fire Protection Association having jurisdiction the majority proposed very rigorous rules; the minority demanded approval practically without restriction. A war of opinions raged. The National Electric Light Association advocated a liberal use of the material, seeing in it a possible means of safely cheapening wiring. The Associated Manufacturers of Electrical Supplies and the Association of Electragists opposed the immediate general use of the material, arguing for a field trial period in which the product could be installed in one-family or two-family dwellings where it might be under observation by the inspectors and would not offer a possible hazard to large gatherings of people.

Meanwhile the Underwriters' Laboratory made tests for one manufacturer and issued a statement of results which was misunderstood by many to be a formal approval. Six other manufacturers entered the field, and the seven organized as a section of the A.M.E.S. Then, after three years of meetings and hearings, the sub-committee reported a majority for rigid restriction and a minority for sweeping approval. Without any visible effort to reconcile these very divergent opinions the N.F.P.A. electrical committee reversed its sub-committee by voting the bare two-thirds majority required in favor of approval for practically unrestricted use and so recommended to the recent annual convention of the National Fire Protection Association. This recommendation was approved on an issue largely that of sustaining or repudiating the committee. Whereupon it became known that in many cities the inspection authorities proposed to enact local regulations barring or largely restricting the local use of non-metallic sheath cable if approved, which, of course, threatened an immediate setback in the progress of the industry toward the realization of inspection uniformity, so sorely needed.

The American Engineering Standards Committee refused to approve this rule, following its policy never to pass anything in which any major interest is in opposition, and referred the matter back to the N.F.P.A. "with the request that an attempt be made to secure a more general agreement." And there we are.

Out of the maze it would seem that these points should have first consideration: The industry wants wiring to be as inexpensive as is compatible with safety and good workmanship. The industry wants progress in the art to be unhampered by unjust restriction on new products. But the industry wants to be sure that it is safe by approaching any new product in a calm and orderly way and prescribing such tests and trial of each innovation as may be satisfactory to the major interests concerned—who are the installers, the manufacturers and the distributors of the material; the suppliers of electricity, whose business is also affected, and the inspectors, who are particularly charged with the protection of the public. And it ought not to take three years for these interests to agree upon a basis of test and trial. For the consideration of any new material to be obstructed for reasons of pure commercial antipathy would be an outrage upon the industry and utter folly.

So the eyes of the industry are very much on the N.F.P.A. electrical committee right now. The measure of its desire and ability to serve the electrical industry as the sponsor for the code will be considered as indicated to no small degree by the spirit and the promptness with which it meets the situation and effects a practical solution of the difficulty by an orderly and acceptable compromise.

Transmission-Line Stability an Economic Problem

SEVERAL Institute papers and much discussion among engineers concerning the matter of transmission-line stability may have created the impression that this is purely a theoretical matter, and lest the practical aspects of the problem be overlooked it is well to consider some of the factors that have brought about this discussion. That electric circuits reach an unstable condition, or have definite power limits, has long been known; in fact, even direct-current circuits reach a point where no more power can be transmitted, i.e., the product of voltage and current begins to decrease with further increase of current.

The question "Then, why worry about stability?" has naturally arisen in the minds of executives and some engineers. The reason is because the problem is the thoroughly practical one of getting power over a line. In the first place, a transmission line costing in the millions of dollars must be worked near the point of lowest transmission cost, which means working as near the stability limit as possible, and in the second place the question arises of how much power a given line or pair of lines is capable of transmitting under both stable and transient conditions. For instance, right now the Pacific Gas & Electric Company must determine whether its two existing 200-kv. Pit River transmis-

sion lines will handle the additional output of the Pit No. 4 plant or whether it will be necessary to build a third 220-kv. line at a cost of several million dollars. Certainly this is a very practical and serious problem. The Southern California Edison Company had a similar condition, but in that case it was quite apparent at the outset that a third 220-kv. line would be necessary to handle the power from a plant under construction, and as a result the Vincent 220-kv. line is now under construction.

Such situations are not peculiar to these two systems, nor are they peculiar to 220-kv. transmission. They arise on every large transmission system, and obviously utility engineers are seeking every possible means to increase the power limits of transmission lines. In the study of transmission stability engineers of the large manufacturers have lent a willing hand and already have done invaluable work and made a number of practical suggestions.

From available field data and studies thus far made the thing simmers down to at least four feasible methods for increasing the power limits to a transmission system. These are, first, lower generator reactance, probably of the order of 12 to 15 per cent; second, higher generator short-circuit ratio, somewhere between the standard ratio of about one to one and up to as high as possibly two to one; third, high-speed generator-field excitation by any one of several methods proposed, and, fourth, by sectionalizing lines and a more widespread use of synchronous condensers over the transmission system.

It may thus be seen that the problem is being attacked from several angles, that considerable progress has been made toward its solution and, further, that it is not altogether a matter of engineering but one of economics as well.

Convention of Association of Iron and Steel Electrical Engineers

THE electrical engineers of the iron and steel industries are considering certain proposals for the standardization of mill-type motors. These proposals exhibit a perfect appreciation of the duties this type of motor is called upon to perform and of the special conditions under which it is installed and operated. The suggested standards cover only dimensional and material design, no attempt being made to specify electrical conditions.

Two other matters of very pertinent concern to the electricity supply industry were also considered at the recent Chicago convention. For yard railways and all larger industrial transportation problems it was agreed that the electric locomotive, taking energy from a central source, possesses advantages of economy, cleanliness and quietness over other methods.

In regard to electric heating a committee stated, inferentially, that the sellers of electric heating equipment and the sellers of energy to operate that equipment were more filled with enthusiasm than facts. The executive disposition to consider electricity first is quite frequently rendered valueless because when the engineer applies to those who should be primed and ready to deluge him with facts and modern instances—the equipment seller and the central station—he is swamped with enthusiastic words alone, mere "sound and fury, signifying nothing." This malady calls for some remedy.

Behind the Scenes in Interconnection

GRATIFYING progress in the handling of interconnections is apparent to engineers privileged to observe these operations at close range. Much remains to be accomplished in anticipating costs, forecasting profits and increasing the reliability of power interchange, but each year shows decided improvements in technique where parties to interchange work in harmony and co-operate intelligently for the common good. The frequency problem is no longer formidable and some extremely fine records are being "hung up" in this direction. On a typical system with five major companies tied together one finds standard frequency maintained hour after hour and on many days per month within from one-tenth to one-twentieth of a cycle, and even where the curve swings out of line with sharp peaks, correction is prompt and effective. Combined steam and hydro-electric systems are now being run so well that electric time service from lamp sockets is finding a much broader application than hitherto, and, more important still, the "hogging" of loads is becoming a thing of the past.

Operating companies are rapidly getting used to new conceptions of plant performance in tying their installations into regional networks. These conceptions enable the individual property management to view with philosophy relative poor local economy for the good of the combination. The object is, of course, to save money for each participant in the tie-in, and such is the result despite the apparent inconsistency of underloading many a large station in order that other interconnected units may function in the exchange scheme.

Upon the type of operating records established and maintained depends much of the success of these interconnections. There is a definite trend toward hourly interchange of load readings and water stages and more comprehensive metering in order that the time during which particular blocks of power were transmitted may be taken into account in more accurately computing the costs of production and delivery. Integrated readings recorded once or twice a day are proving insufficient in many cases to permit the accuracy of cost determination essential to maximum efficiency of interchange. As interconnections become more complex the hour-to-hour study of loads and transfer costs becomes more important and so far, experience indicates, more refined in economic precision.

This improved technique rests upon intercommunication of the first order, and a great deal of thought is now being given to telephone facilities between regional plants. The use of carrier current is becoming more general as an auxiliary, and the routing of regular calls through public exchanges over commercial wires is being avoided more and more. In some instances the transmission of hourly readings has been delayed by too much dependence on commercial lines, reliable indeed, but slow and unsatisfactory for the plant operator and load dispatcher. It is very undesirable to be obliged to "bunch" hourly readings in groups of four to six hours each on account of the partial use of telephone lines for commercial business. These and many other problems, including the more accurate determination of line losses under varied load transmissions, are receiving the attention of operating men, and, above all, reliability of service is being studied with full appreciation of its overwhelming importance in interconnection.

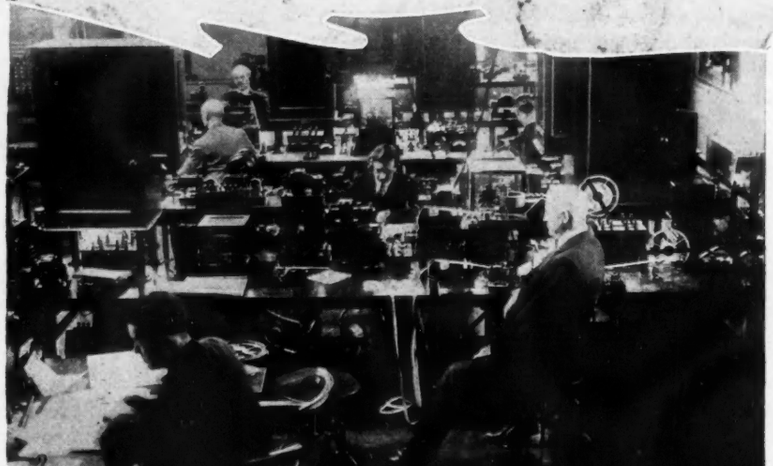
Laying a New 4,000-Mile Transatlantic Cable

THE shore end of the new New York - Newfoundland - Land's End cable was recently landed at Sennen Cove, England. Transmission over this new 4,000-mile cable will be at the rate of 2,500 letters a minute.

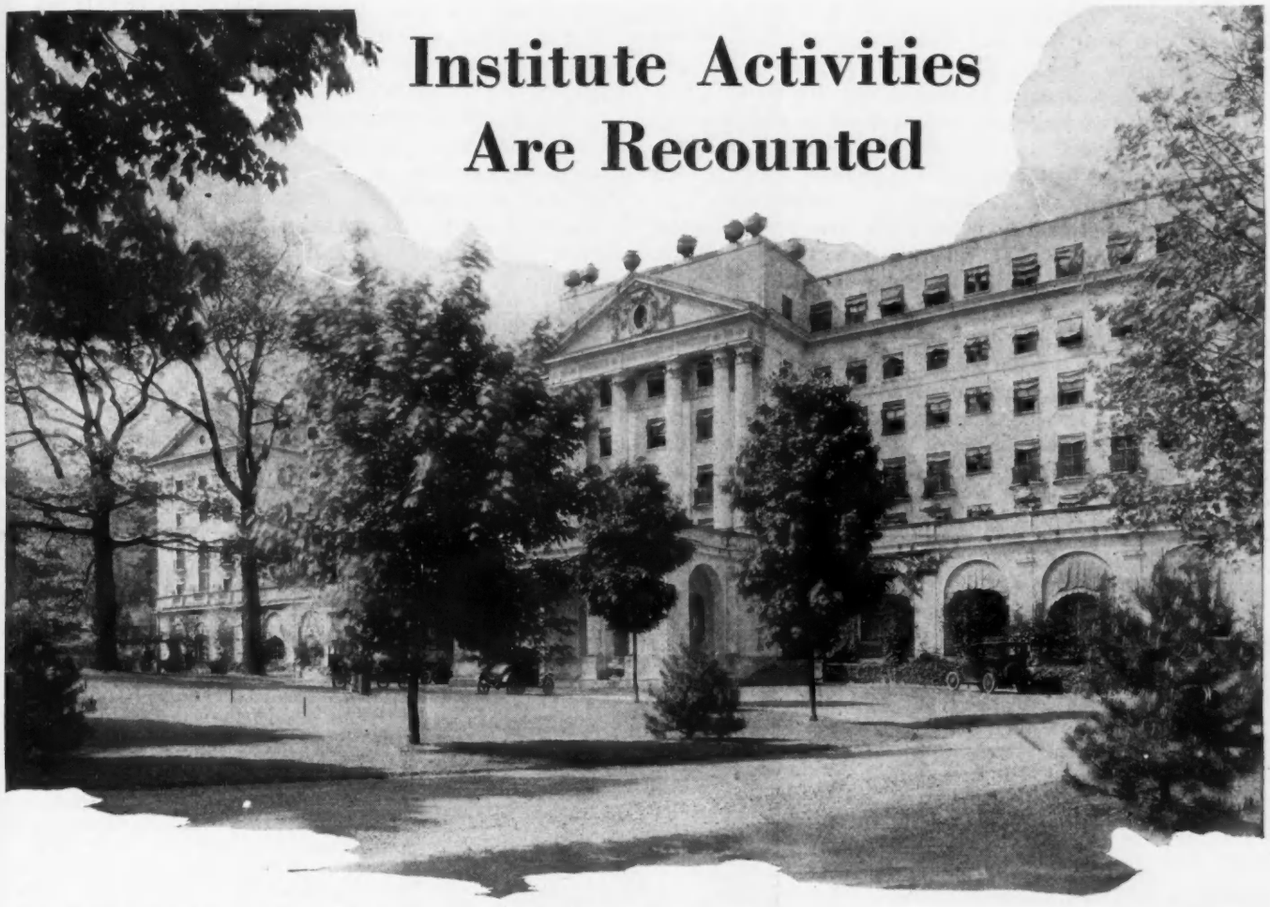
1. Rear-Admiral Goode, general manager of the Western Union Telegraph Company (third from the right), giving a hand with the cable.

2. The interior of the Western Union telegraph office at Penzance, where all messages are received and dispatched.

3. A team of horses pulling the cable ashore. The cable ship *Clyde Firth* is shown in the background.



Institute Activities Are Recounted



THE annual convention of the American Institute of Electrical Engineers was held at White Sulphur Springs, W. Va., from Monday to Friday of this week, June 21-25 inclusive. The program comprehended various aspects of Institute activities and proved a very attractive one to the 350 engineers in attendance.

The committees of the Institute surveyed the progress in engineering in their respective fields of activity. President Pupin, President-elect Chesney and other leaders gave notable addresses on the developments of electrical engineering and accented the need for electrical engineers to participate individually and collectively in national and local affairs. Several high-grade technical papers were presented which recorded advances in the art and gave rise to pertinent discussion.

In addition to its technical features, the convention was most heartily appreciated by those in attendance because of the beautiful environment and the enjoyable social affairs arranged by Farley Osgood as chairman of the convention committee. Golf, tennis, drives in the mountains, tea and bridge parties afforded opportunity for the members to become acquainted in a pleasant atmosphere, and the unusually large number of ladies in attendance added to the social success that was scored.

On Monday the delegates from the sections met in an all-day session to discuss their problems and to recommend changes in policy. Chairman H. B. Smith presided and called upon President M. I. Pupin to open the meeting. Dr. Pupin urged all engineers to recognize their social obligations and their civic duties and suggested that engineers in each community organize on a co-operative basis to present a united and informed opinion on those civic matters on which their opinions could be considered especially competent. He stated that our educational system was defective in that it tended to separate engineers into individual professional groups and argued that basic engineering education called for little if any separation. President-elect C. C. Chesney expressed his appreciation of the work of the delegates and urged their hearty co-operation in the work of the Institute during his term of office.

The subject of affiliating in each community on a co-operative basis with other engineering groups was discussed thoroughly, and while it was acknowledged that local conditions govern specific methods and commitments, the consensus of opinion was for full co-operation of all engineers. A speakers' bureau was urged to help many of the sections and in particular to schedule prominent speakers for semi-public lectures which would help the community understand developments in engineering.

All sections and branches reported a good year, and the regional meetings were commended as excellent agencies for advancing the purposes of the Institute.

PUPIN SURVEYS THE ART

In his inimitable way President M. I. Pupin painted, in his presidential address, delivered at the opening session on Tuesday morning, a picture of science and engineering. He pointed out that electrical science and electrical engineering were closely welded and had become of fundamental importance in the world. Electrical engineering, Dr. Pupin continued, is the science and the art which tell how to make bodies move by

employing an invisible harness to hitch them together. Maxwell, he said, followed the pioneer discoverers to show the operations of this invisible harness, and later workers have told a great deal about its web. Electronic discoveries have marked an epoch in engineering, as the flux that binds together the electron and the proton is the invisible harness of nature. It has led to the conception that the universe is dynamic in structure with manifestations which are local aggregations of electrons. The world is an energized structure which does its share in the work of the whole cosmic structure. How much of this energy can be directed into channels of useful service depends upon the ability of man to make it obedient to his commands. Only a master mind and an exact science can approach the work of making the universe obedient to man, and here the scientists and engineers are at work. In the opinion of Dr. Pupin, the electrical engineers were the first to convert American industry to idealism.

President-elect C. C. Chesney also spoke at this meeting and urged the Institute to keep on unflaggingly with its great work. He pledged himself to do his best to keep the Institute progressive and carry out the policies of his predecessors. After commenting upon the fine accomplishments of the past, he urged that greater recognition be given to research work. He commended co-operative effort to support research on a national scale, but added that the Institute itself should directly aid research workers who are found worthy.

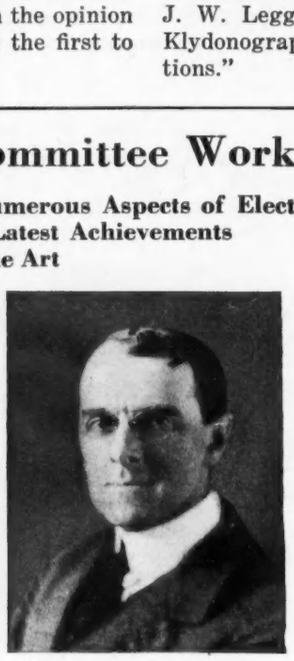
The Institute prizes for the current year were awarded by President Pupin. The first-paper prize was given to R. W. Wiseman for his paper entitled "A Two-Speed Salient-Pole Synchronous Motor," and the transmission-paper prize was awarded to J. H. Cox and J. W. Legg, joint authors of a paper entitled "The Klydonograph and Its Application to Surge Investigations."

Summary of Year's Committee Work

Investigation and Study Concerning Numerous Aspects of Electrotechnical Progress Bring Out Latest Achievements and Trends of the Art

FIRST of the committee reports to be presented Tuesday was that on "research." In the absence of Chairman J. B. Whitehead, the report was read by W. B. Kouwenhoven. Special emphasis was given to the already large and still rapidly growing appreciation of the great importance of pure scientific research if the present rate of application of natural forces and conditions to the uses of mankind is to be maintained. The rewards of industrial research, in money and "kudos," for the solution of immediate and specific problems have drawn many workers from the field of pure science. This condition, together with the insistent demands made on university laboratories by large student bodies, has presented that expansion of pure, sometimes apparently transcendental, research which civilization does, and will continue to, demand for its continuing progress. The "national research endowment," now in course of accumulation, will respond to this need for research in pure science.

In regard to electrical engineering research, although the range of problems studied in the past year has remained unchanged, there has been some shifting of emphasis in various fields. In overhead high-v ltage transmission the greater interest has been in analytical studies of regulation, stability and power limitations. Corona, its laws, character and effect on line performance, presents a number of unanswered questions which are now receiving study. Studies of fuel economy in steam-power-producing machinery have borne fruit in higher efficiencies. Ventilating and temperature-rise problems of rotating machinery have received much well-repaid attention. Noteworthy advances have been made in the fields of communication (short-wave transmission), measurements (cathode-ray oscillograph), welding (atomic hydrogen application), conduction (copper crystals), and in others.



J. B. WHITEHEAD

Power transmission by underground cables has greatly benefited from studies on dielectrics and insulation with reference to gaseous ionization in paper insulation, theory of dielectric absorption and the measurement of dielectric losses.

The highly organized research activities of industries have not been conducive to results of fundamental scientific value, and the unorganized labors of individual workers have, naturally, not been largely productive. However, in the electrical field, results of importance and value are already beginning to appear from the work made possible at various colleges by the supply of funds by the committee on cable insulation research of the National Electric Light Association.

The report of the committee on standards, of which H. S. Osborne is chairman, was presented by C. E. Skinner. The past year has marked the practical completion of the work on Institute standards which has been under way for the past three years. These standards have lately been translated both into Russian and into Spanish, and the Bureau of Foreign and Domestic Commerce of the United States has undertaken the distribution of the latter in the Latin-American countries as a part of its work in the encouragement of trade relations with these countries. The committee has actively co-operated with the International Electrotechnical Commission, with the American Engineering Standards Committee and with the Electrical Manufacturers' Council in the formulation of standards where the interests of these various bodies coincide with those of the Institute committee. A sub-committee will deal with nomenclature in reference to the naming of new concepts and to the clearer definition of established ideas at present ambiguously termed.

Power and energy measurement as affected by circuit conditions on polyphase systems figured largely in the report of the committee on instruments and measurements, of which A. E. Knowlton is chairman. This report was read by J. R. Craighead. Circuits, ungrounded, with one or more grounds on only one side of the metering point and with a ground wire or a number of grounds on both sides of the meter, present radically different conditions under which metering is to be applied. The committee presented typical connection diagrams for these various conditions which fulfilled the requirements and also were the simplest to use. Meter characteristics, such as balance and lack of interference between elements and response to power-factor changes, were stated.

The selection of instrument transformers, taking cognizance of the sources and magnitudes of errors, should not be left with small consideration on account of the belief that the wattmeter can be compensated to correct all transformer errors. Although it is generally accepted that the wattmeter can be so compensated, the correction thus obtained is not always, nor very often, true, and the known error is usually only exchanged for an unknown one. Calculated proportionment of the loads on potential transformers can be used to minimize both phase-angle and ratio errors. The error variation for changes in line voltage within the limits of ordinary regulation is very small. Ratio and phase-angle

errors of current transformers vary appreciably with changes in current, secondary burden and frequency. Phase angles are usually positive and are increased by increase of non-inductive burden. It is desirable, therefore, to keep both the secondary burden and its power factor as low as possible.

A late development in the improvement of current-transformer accuracy is the two-stage transformer designed for use with a special watt-hour meter. This is, in principle, two transformers in one, in which the second transformer corrects the errors of the first by the use of a corrective winding in the watt-hour meter. To insure best results in metering it is desirable that instrument-transformer secondaries should be kept separate and that the leads should be as short as possible.

Although the watt-hour meter is one of the most reliable measurement devices and in general its errors are small under all circuit conditions, yet the increasingly large loads that are measured and the consequent increasing responsibility thus laid upon the instrument make apparently small refinements take on a great importance and justify seemingly extreme precautions against failure or error in registration. Late notable improvements have had to do with the elimination of errors caused by temperature changes. Measurement in connection with dielectrics was the subject of a symposium of papers presented at the regional meeting at Niagara Falls in May.

The report of the committee on communication was read by the chairman, H. P. Charlesworth. The present year is the twenty-fifth since the first application of loading coils to telephone circuits and the fiftieth since the invention of the telephone itself. The extent of the use of the loading coil, for which the retiring president of the Institute is responsible, is given by the estimate that in 1925 1,250,000 loading coils were in use in this country and that this number would be doubled by 1930. The report dwelt at greater or less length on the numerous developments which have taken place in the art of electrical communication in the past year—printing telegraphy, "ticker" transmission, submarine telegraphy and the use of "permalloy" loading, machine-switching telephony, toll cable extensions, new radio-telegraphic systems, transatlantic radio telephony, radio propagation tests, electrical transmission of pictures, telephone service for the deaf, speech characteristics, signal and control systems of all kinds, television and other things.

In regard to inductive co-ordination the work which was instituted two years ago by the formation of a joint committee from the National Electric Light Association and the Bell Telephone System has been progressing very satisfactorily. The study of the problems involved has been much facilitated by the development of improved measuring apparatus and methods.

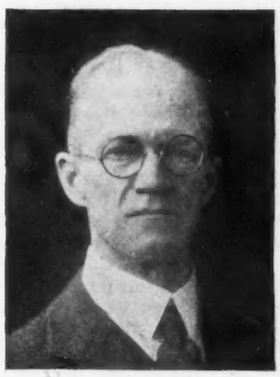
Preston S. Millar, chairman of the committee on the production and application of light, briefed the report of this committee in a very informing and entertaining manner. With the exception of the gaseous conductor lamp, which has in the past year been made

PRESTON S. MILLAR

available in sizes to be used on commercial voltages, there have been no marked changes in the accepted means for the electrical production of light. The report reviewed the present practices of light production and application for the different fields of use and adverted to the progress which is being made by the co-ordination of effort between the Institute, the Illuminating Engineering Society, the National Electric Light Association and the National Research Council. Particular progress has been made in the study of the effect of illumination on production in industrial processes, in street lighting, in the development of a trained lighting personnel in the central stations and in the demonstration of correct lighting to the public.

In regard to the application of electric lighting to traffic control in large cities the report contained a sentence worthy of direct quotation: "The proper solution of the traffic problem in any given case requires real engineering analysis." In conclusion the report stated that electric lighting is undergoing a development under the influence of forces mostly commercial in character but in all ways beneficial.

The last report of the day's session, that of the committee on electrical machinery, of which H. M. Hobart is chairman, was presented by B. L. Barns. The report was divided into various classifications of sub-interests, such as research, ventilation, testing, turbo-alternators, etc., which are included in the general subject. In these divisions were set forth the topics on which the committee was at work or which it could contemplate as a part of its work. As investigations on these topics are completed they will be made the subjects of Institute papers.



H. M. HOBART

Ventilation has been, and is yet, a topic to which much thought has been given, and it has already been the subject of many investigations. Tests and experiments on models and actual machines have yielded many valuable data. Calorimetric methods of tests of electrical machinery have been studied and their virtues and limitations have been determined. Speed increases in turbo-alternators have increased the upper rating limit of single-shaft machines to the extent where 75,000-kw. alternators are now being considered.

Manufacturers are prepared to build waterwheel generators in capacities up to 130,000 kva. in the vertical-shaft type, which still remains most popul r in the United States. The use of air jets for transformer cooling has gained favor in the past year. Much progress has been made in tap-changing transformers, and the spread of rural electrification has inspired the development of high-voltage distribution transformers. The report went into considerable detail on the progress which had been made in the past year on direct-current machines, frequency changers, synchronous and induction motors, high-frequency machines, synchronous converters, voltage regulators and mercury arc rectifiers. As a presentation of the state of the art up to date the report of this committee must be considered an exceptionally fine piece of work.

Animated Debate Evoked

Reports on Transmission and Distribution and Generation of Power Especially Provocative

THE third technical session of the convention, held on Thursday morning, was, like the first one, devoted to committee reports. These were all on subjects of absorbing interest, all exceptionally well presented, and all inspired animated discussion. Of the eight reports offered, the one which drew forth the most discussion was that on power transmission and distribution, abstracted, in the absence of the chairman, P. H. Thomas, by P. H. Chase. The improvements in the design of transmission structures for moving large blocks of power over long distances, the attention directed to low-voltage distribution in the past year, the problem of operating control in interconnections between independent systems, cable design for underground transmission and distribution, stability and load limit in long transmisson lines, insulator improvements, inductive co-ordination of power and communication circuits, rural distribution and foreign practice were all noted, with an amount of detail commensurate with their relative importance to the general subject.

In discussion, W. S. Lee stated, from his experience, that operating control of interconnections could not be vested in a single load dispatcher—a condition to which the paper apparently pointed as the ideal—on account of the sometimes divergent interests of the systems in the interconnection and that,

PRESIDENT M. I. PUPIN

practically, the benefits of interconnection could be secured without unit control.

A very lively discussion on the design and operation of long-distance, high-voltage lines was started by H. R. Summerhayes, who advanced a pet theory regarding a compensated line employing series condensers, the problem being thus reduced to one of line resistance only. Dr. Pupin then raised the alternative of parallel inductances across the line to perform the same function and inquired why they had not been considered. In reply to Dr. Pupin, C. A. Nickle developed an exposition of the relation of the capacitance of a line to the load capacity of the machine furnishing power to it, the amount of power being definitely limited by the line capacitance and being reduced by increase in it.

The report of the committee on protective devices, of which E. C. Stone is chairman, was presented by F. L. Hunt. This report was very exhaustive and covered the entire field remarkably well. Attention was given to automatic substations, their increasing use and application in all fields of electricity utilization and supply; current-limiting reactors, their uses for sectionalizing generating stations, localizing faults and reducing short-circuit current values; lightning arresters, on which no notable new developments have been made in the year past; new devices, such as the Dufour cathode-ray oscillograph and the klydonograph; the progress in the design of oil circuit breakers, switches and fuses, and to a résumé and analysis of the present status and trend of protective relay practice. A supplementary report offered by a sub-committee was concerned with the minima of safe protection in relay practice and with standard symbols for devices on wiring diagrams.

According to the report of the committee on electricity in mining, F. L. Stone chairman, which was offered by H. A. Wynn, the field of electric application is being rapidly and continuously broadened in all types of mining. There is felt to be a strong need for the development of electrical apparatus which can safely be operated in atmospheres containing explosive or inflammable gases or dusts. When this hazard is removed the mining field can be even more rapidly cultivated.

The report of the committee on general power applications was abstracted by the chairman, A. M. MacCutcheon. In this report a large number of applications were covered, reference being made to the developments which the past year has seen. Mr. MacCutcheon took occasion to invite the presentation to the committee of problems in electrical utilization for specific purposes in all industries, as through this clearing house the attention of manufacturers could be directed to industrial needs and solutions of some problems might be found to answer for others.

In discussion of this paper W. S. Lee deprecated what appears to be the accepted practice of partial development of water powers according to the loads in prospect and advocated the full development of each site even if extraordinary measures, such, for instance, as steam generation for process work, had to be resorted to to absorb the excess power.

In iron and steel production, the committee on this subject, of which F. B. Crosby was chairman, reported through A. G. Pierce a considerable growth in electrical applications in special fields, such as heating, melting and welding, as well as in the furnishing of mechanical power. Mr. Pierce also offered the report of the committee on applications to marine work, of which L. C. Brooks is chairman. This report inlucded nothing novel, the inference being that in this field the condition is one of marking time.

G. W. Vinal, chairman of the committee on electrochemistry and electrometallurgy, who presented its report, advocated exact definition of electrical units in terms of the c.g.s. standards. Various new developments in electrochemistry, such as chromium plating and metal melting and alloying, were treated in the report.

Speaking for the committee on power generation, the chairman, V. E. Alden, lacking a prepared committee report, presented his own views on the subject, and these views were highly interesting and provocative, to say the least. After reviewing the progress in steam-station design with especial reference to preheating, high steam pressures and temperatures, new steam generation devices, auxiliary power, continuity of operation in relation to spare capacity, coal processing and other trends, Mr. Alden indulged in a striking analysis of what modern steam plants will be like in twenty or thirty years and how they should be designed so that they will have system value in the next generation. Mr. Alden's paper will be published in the next issue of the ELECTRICAL WORLD, which will also contain a report of the parallel sessions held on Friday, for which six papers were scheduled.

Standards Work Outlined

C. H. Sharp, L. W. Wallace and C. E. Skinner Speak at Evening Meeting for Their Societies

AT AN evening meeting on Wednesday the relation of the Institute to standards-making organizations and the scope and work of these organizations were outlined. Dr. C. H. Sharp told of the work of the International Electrotechnical Commission and showed how it was organized and developed. The work has been done so well that an International Standards Association covering engineering and industry is rapidly coming into being. The facilitation of international trade and commerce is the underlying object of this type of work.

L. W. Wallace, executive secretary of the American Engineering Council, said that his organization now represented twenty-six bodies with a membership of 42,000. Some of the work undertaken by the council was outlined. This work included consideration and advocacy of congressional acts dealing with topographic mapping, Muscle Shoals, the Patent Office, salaries of federal judges and radio broadcasting. Yearly reports are made on vital topics. Some of these have been waste in industry, the twelve-hour shift, the indus-

trial coal supply, commercial aviation, accidents and production.

C. E. Skinner, chairman of the American Engineering Standards Committee, described the task of that organization. He urged that all standards-making bodies start work under its rules of procedure and said that study was being carried on with regard to a closer co-ordination of standards activities in this country and internationally.

Machinery, Circuits and Railway Practice

Topics in These Fields Give Rise to Valuable Papers and Discussions in Wednesday's Parallel Sessions—Leading Engineers Take Part.

ON WEDNESDAY morning two parallel technical sessions were held and several fine papers brought out good discussions. In one of these sessions an excellent paper was presented by R. E. Doherty and C. A. Nickle. These authors extended the theory of the Blondel two-reaction analysis of synchronous machinery. The harmonics as well as the fundamentals were analyzed, this refinement having become necessary in order to study leakage reactance in more detail and to determine power-angle displacements more accurately. The basic principle lies in getting the phenomena caused by field current and armature current separately and then superimposing them to find the resultant. Leakage reactance was found to result from the rotation of harmonic flux waves at fundamental frequency, and the extended Blondel treatment gave better quantitative determinations of the power angle of synchronous equipment than could be otherwise obtained.

In discussing the paper C. A. Adams pointed out that any machine analysis could be approached by studying either mmfs. or fluxes and that either method of approach gave the same result if the reluctance of the magnetic circuit was constant. Since the reluctance varies in salient-pole machines, the Doherty paper gave a method which was accurate and determined the belt leakage. Whether it determined the tooth leakage is, however, a matter of definition.

P. L. Alger said that the method of analysis outlined by the authors was general in application and can be extended even more to cover the design of any type of synchronous machine. Dr. M. I. Pupin said that machines of special characteristics were often in demand and that any fundamental and general method of design was valuable. R. D. Evans asserted that the two-reaction method of analysis of synchronous machines was of great importance in stability analyses.

PRESIDENT-ELECT C. C. CHESNEY

A paper by F. W. Lee treating of graphical solutions for alternating-current circuits created a great deal of discussion which pertained to educational methods. Dr. Pupin said that many electrical circuits have reactions which vary with time and which have no direct relation to the electromotive force. Some of these reactions cannot be treated by graphical methods such as can be used in electrical circuits, and such methods do not give any understanding of the physics of the phenomena involved. He urged greater use of thorough analyses in the colleges.

C. A. Adams observed that there was a tendency to slur over exact methods of analysis in favor of approximate methods in engineering teaching. Especially did he condemn the non-rigid treatment of fundamental problems by teachers, but he added that it was not possible to get exact solutions of some problems. In this event it was necessary to have students understand the whole problem and know the reason for and limitations of approximate solutions.

Dr. Harold Pender also urged that rigid methods of analysis be used in teaching and declared that graphical methods should be used only when an understanding of the basic physics had been established. R. E. Doherty agreed with the necessity for thorough analyses but thought that graphical methods were useful if used intelligently.

MULTIPLEX WINDINGS

A paper by C. C. Nelson on multiplex windings for direct-current machines proposed a greater use of this type of winding because of its possibilities for better commutation.

J. L. Burnham, in discussing the paper, said that if there was a fractional number of commutator segments between brush sets with multiplex winding there resulted two parallel circuits which had pulsating voltages. First one circuit, then the other, carried the load and this resulted in causing the brushes to burn in zones. He doubted whether there were any advantages of the multiplex winding which could not be obtained by well-designed winding of the usual type.

PAPERS ON SUBSTATIONS AND RAIL ELECTRIFICATION

A very interesting paper on remotely controlled substations was presented by W. C. Blackwood in the other parallel session. The installations described by Mr. Blackwood are in the metropolitan district of New York, where load is varied and heavy and where anything less than 100 per cent continuity of service is almost unthinkable. It was on this latter account that preference was given to remotely controlled substations as compared with supervised automatic substations.

As was brought out in the paper and later more fully stressed in discussion by C. M. Gilt, the value of remote control and condition indication is derived principally from the speed at which feeder outages are detected and the consequent lessening of lost time in getting them corrected.

In spite of the apparent superiority of manual remote control in this particular case, C. L. Lichtenberg held that remote control was only a transition

stage on the way to full automatic operation, an opinion which gained added weight from the remarks of others taking part in the discussion.

The characteristics of high-speed operation, discrimination, reduction of trip point with reduction in line voltage and polarization all contribute to the success of the high-speed circuit breaker in railway feeder networks, according to a paper by J. W. McNairy. The operation of this type of breaker is so fast as to permit the current rises due to short circuits to be regarded as transient phenomena, the functioning of the device being dependent on the speed of rise of current value rather than on the attainment of a determined value.

That the equipment provided for regenerative braking on direct-current locomotives should be determined by the grade conditions over which a locomotive is to operate was a general conclusion to be reached from the presentation of a paper by Alfred Bredenberg, Jr., on this subject. Where grades are of 1½ per cent or less, excitation current for regeneration may safely be taken from one of the traction motors, but where grades exceed this figure an independent source of excitation current should be provided.

Progress in Lignite Power Plant Construction in Germany

Changes in Methods of Fuel and Ash Handling, Additions to Boiler Plant and Turbine Installation and Raising of Power Factor from 0.67 to 0.90 Greatly Increase Capacity of Zschornewitz Power House

By A. PEUCKER
Managing Director of Elektrowerke A. G.

THE Zschornewitz power plant, built in 1915 by the A. E. G. (General Electric Company of Germany), is one of the best known lignite power plants in Germany. Thorough descriptions of this plant have appeared in the technical press, written by the late Dr. Klingenberg, one of the managing directors of the A. E. G. The first installation comprised eight steam turbines, totaling 128,000 kw., served by four boiler houses. After the war the Elektrowerke A. G. took this company over and added two turbines, totaling 32,000 kw., and built an additional boiler house. These two latter turbines were of the same general construction as the initial installation. The necessary expansions in the Zschornewitz plant for the current year clearly illustrate the forward strides that have been made during the last decade in large lignite power plant construction.

The original coal supply was obtained from the Golpa open-pit mine, which is located adjacent to the power plant and from which the fuel was transported by means of a chain railway operated with cars of 2° tons capacity. This railway was replaced in 1922 by a new system consisting of electric locomotives and cars having a capacity of 20 tons. The tracks of this system lead directly to the main bunker of the power plant. This resulted in substantially reduced fuel-supply costs and at the same time eliminated the hazards of interruptions of the chain-railway system during the winter months.

In the initial construction ash disposal was effected by manually loading small ash cars, which were then conveyed by a locomotive to a point outside the boiler house, where they were reloaded and transported to an abandoned open-pit mine. This procedure was not only expensive but also very disagreeable for the people who lived near by. A new system was installed, utilizing water under pressure, by means of which the ashes were conveyed directly from the ash pits to the ash dump located about three-quarters of a mile from the boiler house. This improvement entirely eliminated manual labor and greatly improved the living conditions of the vicinity.

Improvements in the design of the cooling towers, which were necessary in this plant because of the inadequacy of the supply of cooling water, have resulted in units with an hourly capacity of 353,100 cu.ft. in place of the old ones of 134,200 cu.ft. Material savings have also been accomplished in the ground space requirements.

The older steam turbines are thoroughly reliable, but they are not satisfactory from the point of view of steam consumption. Preparations have therefore been made to replace these turbines with units of modern design. The generators and condensers of the old units will remain unchanged. An improvement in steam consumption will be obtained and at the same time the ratings of the old generators will be increased by 25 per cent. This increased capacity is made possible by increasing the power factor to 90 per cent, whereas the older units had been used with a power factor of only 67 per cent. It has also been possible to increase the capacity of the boilers through the introduction of various small improvements, which will not be described at this time. Due to the various improvements previously mentioned, the capacity of the old plant has been increased about 25 per cent without making any large expenditures other than those involved in the replacement of the steam turbines.

Three new steam turbines will be installed during 1926. Two of these units, each with a capacity of 12,500 kw., will serve the power requirements of the plant and various near-by industrial uses. They are located side by side, and together occupy no more space than one of the older machines rated at 16,000 kw. The other new turbine will have a capacity of 37,500 kw. and will serve the increased power demands of the system. The two smaller machines will have two cylinders, whereas the larger machine will have three cylinders. These three new machines will use stage bleeding for heating the condensate to more than 100 deg. C.

Special arrangements were necessary at the boiler house. Since the water is brought back to the boilers at a temperature which is the same as that provided

at the outlet of the economizers, the flue gases of the boilers cannot be used as they formerly had been. The condensate, after it has been de-aërated, will be conducted to economizers having a heating surface of 100 per cent of the heating surface of the boilers themselves. The condensate will be heated to a maximum of 160 deg. C. in the new economizers. Attached to the economizers and between the boilers and the economizers are special air preheaters which preheat the air up to 160 deg. C. The boilers themselves are constructed with inclined tubes and are provided with four drums, according to a plan that has been developed by the Elektrowerke in co-operation with the manufacturers, and are specially designed for large lignite-burning units. The boilers have been designed with a heating surface of 10,764 sq.ft. in order that the drums may be built out of a single piece of sheet steel, with only a longitudinal joint which has been welded and not riveted.

COMPARATIVE DATA ON OLD AND NEW TURBINES

	Area, Sq.Ft.	Height, Ft.	Cu.Ft.	Installed, Capacity, Kw.	Sq.Ft. per Kw.	Cu.Ft. per Kw.
Old turbine room turbines No. 1 to 10	39,250	59.0	2,322,000	160,000	0.2462	14.52
New turbine room	11,400	72.2	819,000	62,800	0.1819	13.07
Main turbine room, Rummelsburg power plant, Berlin	38,180	....	2,730,000	210,000	0.1819	*12.96
				Steam Tons per Hour	Sq.Ft. per Ton	Cu.Ft. per Ton
Old boiler houses Nos. 1 to 4, Zschornewitz, without bunkers	133,000	57.4	7,650,000	4×175	190.4	10,920
Boiler house No. 5, Zschornewitz	35,170	59.7	2,041,000	230	148.5	8,870
Boiler house No. 6, Zschornewitz	36,800	66.3	2,440,000	480	76.4	5,080
Boiler houses, Rummelsburg power plant, Berlin, bituminous coal	61,600	....	5,350,000	2×520	59.2	†5,160

*Excludes special preheating turbines.
†Excludes special coal-pulverizing space.

The boilers are provided with mechanical stokers of the Seyboth system. They have an ordinary rating of 8.26 lb. per square foot and an over-all rating of 10.325 lb. per square foot. Raw lignite often contains large percentages of sand, which quickly diminishes the steaming capacity of the boilers. In order to obviate this difficulty an auxiliary firing system has been worked out by means of which dried pulverized fuel is blown into the furnace. This auxiliary firing system was worked out on a number of the older boilers and has resulted in an ability to increase the boiler ratings from 30 per cent to 50 per cent within a few minutes.

The new boiler house to be built in 1926 is only slightly larger than the older boiler plants. It will contain twelve boilers equipped with the auxiliary firing devices as mentioned above, and which are able to furnish steam for 90,000 kw. of the new type of turbines. At the start only four new boilers will be installed. Each of the older boiler rooms provided steam for 32,000 kw. of the older type turbines. The new boiler plant, supplying 90,000 kw., thus represents a very important step forward.

In extending the turbine room, the older portion was raised about 13 ft., so that the cranes can serve both the old and the new turbine rooms, and thus sufficient head room has been provided to handle the new turbo-generator units. It will thus be possible to replace the older machines with newer and larger units, with the further changes in the building itself.

The accompanying table shows clearly the progress that has been made in the lignite power plant construction in the last few years. The figures of the new power plant at Rummelsburg, which is being constructed for pulverized bituminous coal, have been shown in the tabulation for comparative purposes. These figures were taken from the article published in the ELECTRICAL WORLD, Sept. 26, 1925, page 652, by the designer of the Rummelsburg plant, Dr. Klingenberg. These data do not take into consideration the fact that three reheating turbines, each of 10,000 kw., must be provided for each of the large units, located in a special turbine room, and a special building must also be provided for the pulverizing and drying of the fuel. Furthermore, since the publication of the above-mentioned article, both turbine and boiler houses have been elevated.

This comparison shows that a well-organized and well-designed lignite power plant can be superior, from the point of view of utilization of space, even to the best of the bituminous coal plants, a fact that has been a cause of considerable controversy in the engineering profession. By means of the method described in this article it has become possible to build large lignite plants cheaper than at the beginning of the period of high prices, despite the increased unit costs. And since the long-distance transmission lines, in consequence of the improved methods of construction, can be built at the same prices in relation to their relative capacity, it is clear that the ability of long-distance power transmission to compete with local generating plants is much wider in scope than ever before.

Power and Parks from the Standpoint of the Engineer

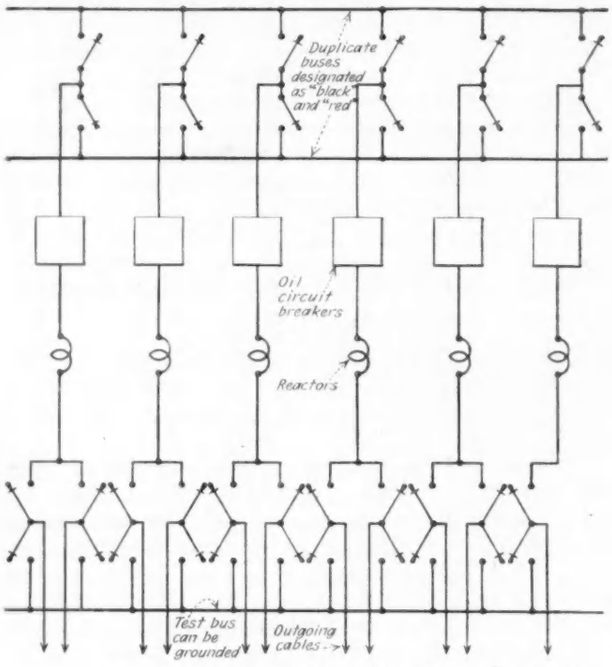
IN ADDRESSING the national conference on state parks, held at Hot Springs, Ark., last week, O. C. Merrill, executive secretary of the Federal Power Commission, said:

"It has been too frequently the practice in the past, not only in connection with private development but with government projects also, to avoid the cost of clearing reservoir sites by merely flooding out the timber and leaving a forest of dead trees and brush projecting from the water surfaces to mar the landscape for generations. Almost without exception, and invariably where there is probability of recreational use, the commission requires the removal from the floor of the reservoir of all trees and brush that would project above the level of the lowest drawdown and the complete clearing of the entire margin between highest and lowest water. Such clearing in individual cases has cost hundreds of thousands of dollars. These reservoirs, however, will become more and more centers of recreation, places for camping and boating and summer homes and will add many areas that may be availed of by the states at moderate cost for development as public parks. On Big Creek, in California, for example, a mountain valley at an elevation of 7,000 ft. has been turned into a beautiful lake by the creation of power dams at its outlet. Hotels have been erected, camp sites have been developed by the Forest Service, and an attractive mountain area hitherto inaccessible is visited annually by many thousands of people. The handling of the clearing of the bed and margins of the reservoir site at Muscle Shoals has been so well done as to create the semblance of a natural lake, far more attractive from the scenic standpoint and far more useful from the recreational standpoint than the flood-swept banks and islands and sandbars which formerly existed."

Group-Operated Disconnecting Switches

BY L. BIRCKHEAD
Assistant Electrical Engineer Consolidated Gas, Electric Light & Power Company of Baltimore

MODERN power house and substation design exhibits a fine determination to develop operating methods and types of equipment that make larger and larger contributions to the two principal ideals of the central-station business, continuity of service and safety of operation. One manifestation of progress in this regard lies in the lately devised methods for handling the operation of disconnecting switches that are applicable to all bus arrangements. These methods employ assemblies of cranks, rods and operating handles that result in the group functioning of disconnecting switches from a remote operating point. One of these

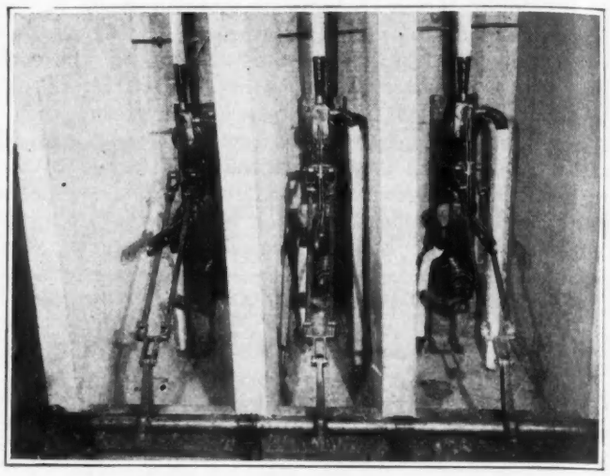


TYPICAL SINGLE LINE DIAGRAM OF MONMOUTH STATION

methods, as installed in the power houses and substations of the Consolidated Gas, Electric Light & Power Company of Baltimore, where it is giving much satisfaction, will be described in this article.

Although all of the applications of remotely operated disconnecting switches in the Baltimore system are not the same in mechanical detail, a description of the arrangement in a single station should present a fair conception of the general idea. In the accompanying drawing is shown a single line diagram of a part of the Monument Street substation. At the top are two buses, designated as "Red" and "Black" and located on different gallery floors. The taps from the two buses are brought through wall bushings to the jaw terminals of single-throw disconnecting switches. The lead from the oil circuit breaker is brought up to the blade terminals of both switches. It is thus possible to feed from either bus or from both buses.

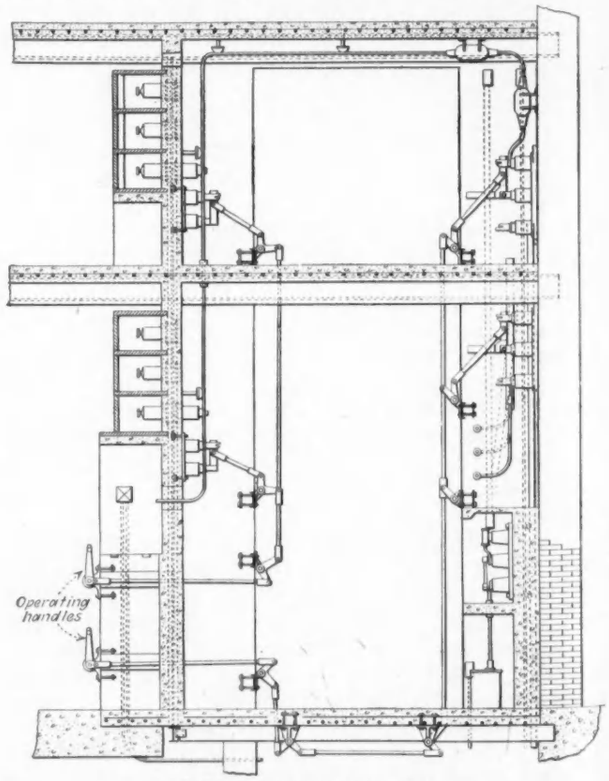
The load conductor from the breaker is carried through a reactor to the top jaws of two double-throw disconnects, each with a special blade as though there



OPERATING ARMS ON DISCONNECTING SWITCHES

were two blades set in the same plane 90 deg. apart. The blades are connected to two outgoing cables, one to each switch. The bottom jaws of these switches are tied to a bus, which may be energized for testing or grounded through a breaker. The operation of all of the disconnecting switches appertaining to one oil circuit breaker is accomplished from the location of that breaker as shown in an accompanying illustration.

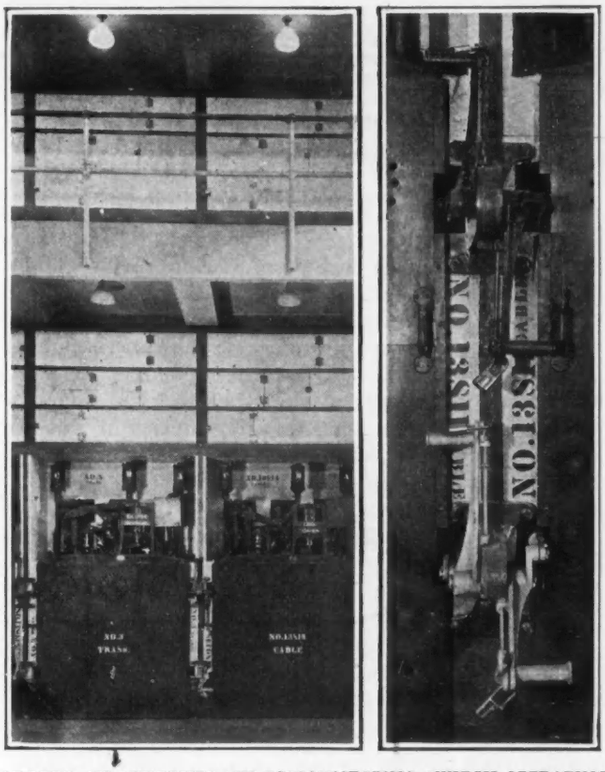
When the operator stands in front of the oil breaker to select the proper disconnecting switch handle to be operated, he has before him a target showing the word "Open" or "Closed," which indicates the position of the breaker. The disconnecting switch handles are padlocked in position (shown in detail in an accompanying illustration, so that a time delay to unlock the switch is imposed, forcing on the operator an opportunity to check up his movement in the performance of a switch-



LAYOUT OF OPERATING PARTS

ing order. Each breaker has four disconnecting switches in circuit with it, the operating handles for which are located two on each side of the breaker compartment and are mounted on the separating partitions. One of the two top handles is painted red and the other black according to the bus on which it closes. These handles are locked open or closed. The two lower handles control the double-throw switches on the outgoing cables and may be locked in any one of three positions—closed on breaker, open, or closed on test bus.

The location of the switch handles immediately close to the oil breaker, together with the indicating target on the breaker itself and the time lapse imposed by



AT LEFT, OIL SWITCHES AND DISCONNECTING SWITCH OPERATING HANDLES. AT RIGHT, CLOSE-UP OF DISCONNECTING SWITCH OPERATING HANDLES

unlocking the handle, effectively diminishes the chance of error on the part of the operator. The cable disconnects with their test bus positions remove the necessity for the operator to place ground or test jumpers on the cable with the attendant possibility that he will make a mistake, costly to himself and the company.

The handles at the breaker compartment are connected by means of suitable arrangements of pipe rods and bell cranks, as shown, to shafts below and across the front of the switches, from which the motion is transmitted to the switch blades through insulating arms (see illustration). None of these remote operated switches is equipped with locks to prevent opening under short circuit. They are not necessary because of the lock on the handles and the natural resistance to motion of the operating mechanism and also because the arms to the switch blade and the arms on the gang shaft flatten out to a very large included angle, as shown in an accompanying illustration. Practically any interlocking arrangement with other switches, breakers, compartment doors, etc., can be included in the operating mechanism.

In view of the radical decrease of hazard to life and property and to continuity of service the increase of cost of remotely operated disconnecting switches over the usual installation of switches opened and closed with a stick is not great. In the case of the single-throw switches, an approximate cost for a three-pole switch plus operating mechanism installed complete would be $170, as against $100 for three single-pole, stick-operated switches. A three-pole double-throw switch with 90-deg. blades plus operating mechanism installed complete costs about $230, as against $185 for three single-pole, stick-operated, selector-type disconnects. The interest on the additional cost of these switches is not a high annual insurance charge for the added protection.

April Output 13.1 per Cent Over Last Year

A TOTAL of 5,401,594,000 kw.-hr. of energy was generated by the central stations of the country during April, or at an average daily rate of 180,000,000 kw.-hr. These figures indicate an increase of 13.1 per cent over the output of April last year, which is only slightly above the increase reported for the first quarter of the year, 12.5 per cent. The April output was 1.1 per cent below the estimated normal for that month, this normal being based on the operations for the past five years.

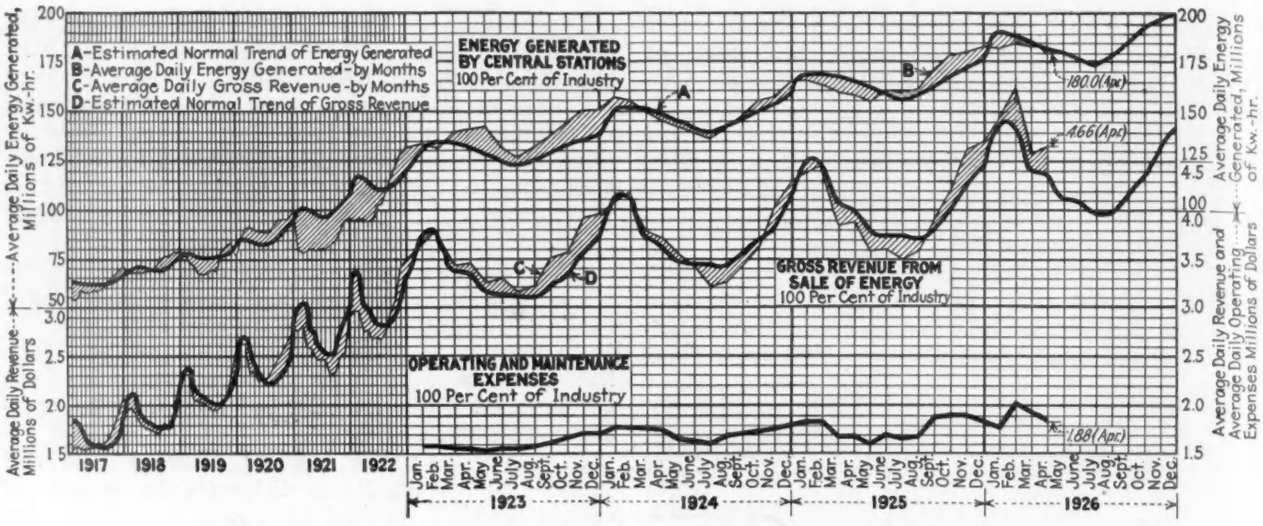
The gross revenue for April totaled $139,800,000 and the operating expenses totaled $56,500,000. A detailed discussion of the financial operations of the industry will be found in the "Financial and Corporate" section of this issue.

A very noticeable increase in the amount of energy consumed for industrial power purposes is indicated for

TABLE I—GENERATION AND DISTRIBUTION OF CENTRAL-STATION ENERGY IN THE UNITED STATES
(100 per Cent of the Industry)

Month	Kw.-Hr. Generated Monthly *			Estimated Distribution of Energy Generated										Energy Purchased by Public Utilities for Resale, Kw.-Hr.	
				Total Energy Consumption by Central-Station Customers, Kw.-Hr.		Energy Consumed for Lighting, Kw.-Hr.		Energy Consumed for Power, Kw.-Hr.		Energy Sold to Electric Railways, Kw.-Hr.		Energy Used in Intracompany Business, Including Line Losses, Kw.-Hr.			
	1926 Thousands	1925 Thousands	Per Cent Inc.	1926 Thousands	1925 Thousands	1926 Thousands	1925 Thousands	1926 Thousands	1925 Thousands	1926 Thousands	1925 Thousands	1926 Thousands	1925 Thousands	1926 Thousands	1925 Thousands
January....	5,683,055	5,121,776	+11.2	4,586,055	4,133,776	1,260,000	1,168,000	2,771,055	2,429,776	555,000	536,000	1,097,000	988,000	1,010,000	690,000
February...	5,190,645	4,621,235	+12.3	4,188,645	3,729,235	1,128,000	1,044,000	2,559,645	2,201,235	501,000	484,000	1,002,000	892,000	983,000	680,000
March.....	5,727,606	4,963,857	+15.3	4,621,606	4,008,857	1,212,000	1,123,000	2,854,606	2,346,857	555,000	536,000	1,106,000	958,000	1,090,000	796,000
April.....	5,401,594	4,777,289	+13.1	4,358,594	3,854,289	1,152,000	1,067,000	2,654,594	2,253,289	552,000	534,000	1,043,000	923,000	1,040,000	763,000

* Data on "energy generated" are those collected and published by the United States Geological Survey for all public utilities minus such data as are collected on energy generated by electric railway companies, reclamation service and manufacturing plants. The data are, therefore, for the electric light and power industry only.


A-Estimated Normal Trend of Energy Generated
B-Average Daily Energy Generated-by Months
C-Average Daily Gross Revenue-by Months
D-Estimated Normal Trend of Gross Revenue
ENERGY GENERATED BY CENTRAL STATIONS
100 Per Cent of Industry
GROSS REVENUE FROM SALE OF ENERGY
100 Per Cent of Industry
OPERATING AND MAINTENANCE EXPENSES
100 Per Cent of Industry
Average Daily Energy Generated, Millions of Kw.-hr.
Average Daily Revenue, Millions of Dollars
Average Daily Energy Generated, Millions of Kw.-hr.
Average Daily Revenue and Average Daily Operating Expenses Millions of Dollars
1.80 (Apr.)
1.66 (Apr.)
1.88 (Apr.)
1917 1918 1919 1920 1921 1922
1923 1924 1925 1926

THE GROSS REVENUE DURING APRIL WAS 5.4 PER CENT ABOVE THE ESTIMATED NORMAL

the first third of the year. For January the consumption for power purposes had increased to 14.1 per cent over last year, in February 16.3 per cent, in March 20.8 per cent, and in April the consumption by this type of customers had increased to 17.9 per cent over April of last year.

The reports indicate that considerably more energy is being generated in hydro-electric plants this year than last. In March the energy generated in hydro-electric plants totaled 2,237,293,000 kw.-hr., an increase of 11.4 per cent over last year, and in April a total of 2,280,763,000 kw.-hr. was generated in this type of plant, an average increase of 14.6 per cent over last year. There has been a noticeable drop in the amount of fuel oil used in central-station plants. In March the amount of fuel oil consumed was 15.3 per cent under that in 1925, and in April the consumption of this type of fuel was 5.4 per cent under April of last year. The amount of gas consumed during April, however, was 4.2 per cent over April of last year.

A very noticeable decrease is indicated in the operating ratio or ratio between operating expenses and revenue. The operating ratio in April for companies having steam plants only was 44.9 per cent, as against 47.2 per cent in April of last year. Also, the April operating ratio was below that of last January, an unusual condition in the finances of the industry.

TABLE II—OPERATING RATIO OF CENTRAL-STATION COMPANIES

Month	Operating Ratio					
	Steam Plants		Hydro Plants		Combined Hydro and Steam Plants	
	1926	1925	1926	1925	1926	1925
January	45.2	45.3	25.0	25.0	41.3	43.4
February	41.3	43.4	34.1	28.9	39.8	40.5
March	42.0	44.0	33.0	29.0	40.0	40.5
April	44.9	47.2	32.4	29.7	41.8	41.9

TABLE III—CENTRAL-STATION FINANCIAL OPERATIONS FOR FOUR MONTHS IN THE UNITED STATES
(100 per Cent of the Industry)

Month	Total Gross Revenue from Sale of Energy†			Estimated Distribution of Gross Revenue								Total Operating and Maintenance Expenses‡	
				Lighting Customers		Power Customers		Electric Railways		Other Public Utilities			
	1926 Thousands	1925 Thousands	Per Cent Inc.	1926 Thousands	1925 Thousands	1926 Thousands	1925 Thousands	1926 Thousands	1925 Thousands	1926 Thousands	1925 Thousands	1926 Thousands	1925 Thousands
January	149,700	$137,300	9.6	$98,100	92,500	$37,500	$33,500	$5,000	$4,800	$9,100	$6,500	$58,700	$55,100
February	145,400	128,700	13.0	94,000	86,100	36,900	31,600	4,800	4,500	9,700	6,600	56,900	51,500
March	141,800	124,000	12.4	90,400	82,600	37,100	30,000	4,800	4,600	9,500	6,800	59,200	54,200
April	139,800	122,400	14.0	89,700	81,100	36,000	29,800	4,900	4,700	9,200	6,800	56,500	53,300

† Aggregate gross revenue from actual consumers, and sales to other public utilities for resale, involving a certain amount of duplication.
‡ Do not include interest, taxes, depreciation or sinking fund.

TABLE IV—OPERATIONS OF CENTRAL-STATION HYDRO AND FUEL PLANTS IN THE UNITED STATES *
(100 per Cent of the Industry)

Month	Energy Generated						Fuel Consumption								
	Hydro Plants			Fuel Power Plants			Coal			Oil			Gas		
	1926 Thousands of Kw.-Hr.	1925 Thousands of Kw.-Hr.	Per Cent Increase	1926 Thousands of Kw.-Hr.	1925 Thousands of Kw.-Hr.	Per Cent Increase	1926 Short Tons	1925 Short Tons	Per Cent Increase	1926 Barrels	1925 Barrels	Per Cent Increase	1926 Thousands of Cubic Feet	1925 Thousands of Cubic Feet	Per Cent Increase
January	1,928,775	1,676,526	+15.0	3,754,280	3,445,240	+ 8.9	3,272,761	3,230,153	+ 1.3	972,131	1,329,855	—27.8	3,661,363	2,898,225	+26.3
February	1,886,471	1,725,877	+ 9.3	3,304,174	2,895,358	+14.1	2,886,534	2,741,313	+ 5.3	683,580	959,595	—28.8	3,328,365	2,457,463	+35.0
March	2,237,293	2,009,222	+11.4	3,490,313	2,954,635	+18.1	3,071,092	2,754,265	+11.5	670,248	791,496	—15.3	3,896,594	3,214,656	+21.2
April	2,280,763	1,988,621	+14.6	3,120,831	2,788,668	+11.9	2,758,943	2,587,289	+ 6.6	622,394	658,080	— 5.4	3,507,983	3,367,663	+ 4.2

* As collected by United States Geological Survey. The data are for the electric light and power industry only.

Heating Pitch Electrically

Close Control of Temperature Requirements Insures Satisfactory Results—Mechanical Problems Simplified in 198-Kw. Installation with Capacity of 7,000 Gal. of Pitch for Steel Pipe Coating

By LEE P. HYNES
President Hynes & Cox Electric Corporation, Albany, N. Y.

DUST, corrosion and electrolysis quickly destroy unprotected steel, especially when it is in contact with moist earth, and much study has been devoted to methods of protection against these enemies. Although this is not a new problem, it has a growing economic importance through the rapid expansion of large systems of steel piping for water supply, drainage and hydro-electric development.

The best method so far discovered is the old one of applying a coating of hot coal tar, pitch or some asphaltum compound to the surface of the metal. Long usage has proved these coatings effective preservatives for steel when properly applied, but much difficulty has heretofore been experienced in the practical operation of this process.

The materials suitable for coating steel pipe vary considerably in composition, but all of them are compounds of heavy hydrocarbons and more volatile oils, and for convenience they will simply be referred to here by the common term pitch. They are rather complex in character and are hard to keep uniform, as heating tends to evaporate the more volatile constituents and precipitate the heavier ones. Definite specifications as to composition of dip have been worked out for various kinds of service and the chief problems are those of practical application.

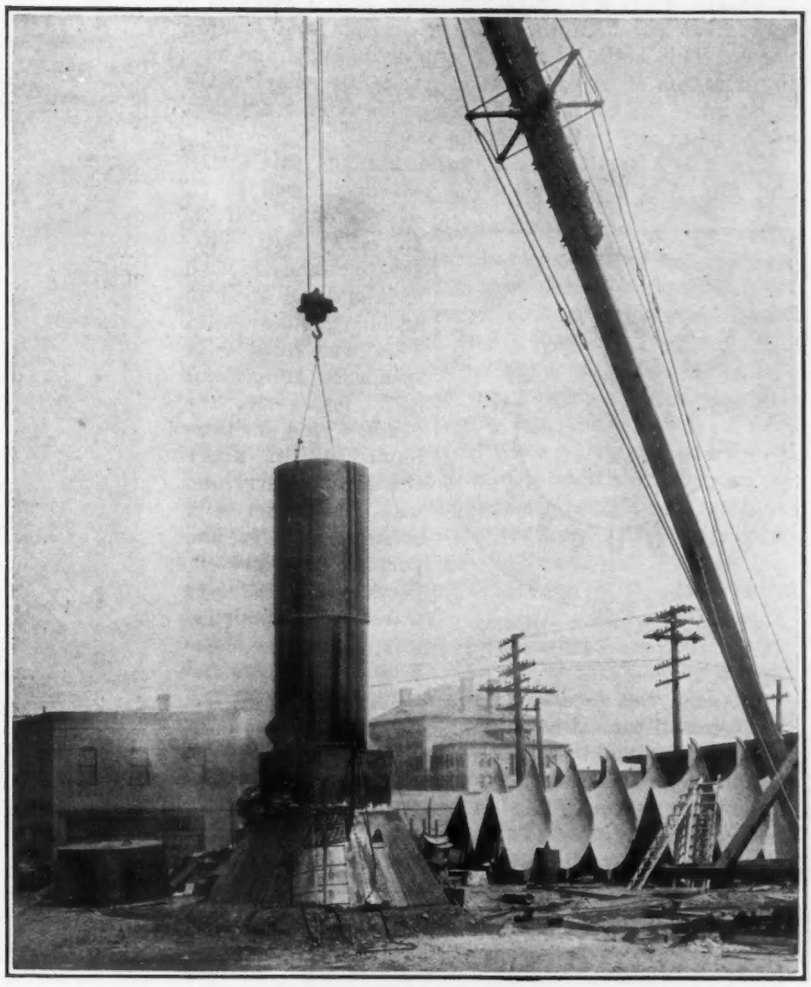


FIG. 1—DIPPING STEEL PIPE IN ELECTRIC KETTLE

The late Prof. George C. Whipple of Harvard University and other scientists have determined that there is a critical temperature at which each mixture should be applied to the steel. This ranges from 300 to 400 deg. F. for different compounds, but for a given material must be maintained within 5 deg. F., plus or minus, of the proper temperature. Otherwise the quality of the coating deteriorates in adhesiveness and durability. Furthermore, the composition of the dip must be kept constant by stirring to prevent precipitation, and by the frequent addition of volatile oils to replace evaporation. The surface of the work must be perfectly clean and the steel must be heated throughout to the same temperature as the dip. Only when all these conditions are maintained can a definite dipping specification be satisfactorily complied with.

Many difficulties confront the manufacturer of large steel pipe in attempting to apply a specified coating of pitch to steel sections up to 6 or 8 ft. in diameter and 20 to 40 ft. long. It is obviously impracticable to preheat the steel accurately and uniformly and then apply the hot pitch at exactly the right temperature. The only practical plan is to immerse the entire pipe in a mammoth kettle of hot pitch. However, pitch is very hard to heat in large volumes, because of its poor thermal conductivity and its sluggish convection currents. As the interior of the container must be kept free from obstructions to the work, steam coils have been used around the walls and in the bottom, but as superheated steam is required, an expensive installation is necessary. Furthermore, the sludge soon buries the

pipes and retards the heating. Cleaning the pipes is very difficult, as the kettle must be drained and the gummy material scraped off while hot.

Walsh's Holyoke Steam Boiler Works, Holyoke, Mass., a leading manufacturer of large steel piping, desired an improved coating process and engaged the Hynes & Cox Electric Corporation, electric heating engineers, Albany, N. Y., to co-operate in the design and to manufacture and install the necessary heating equipment. Since pipe sections up to 6 ft. in diameter and 36 ft. long were to be coated, the only feasible method was to construct a vat of ample dimensions to receive such pipe sections, and submerge them in hot pitch. Accordingly, a vertical kettle was sunk in the earth at a convenient point in the outdoor storage and loading yards. This kettle is served by a swinging crane having a radius of 100 ft. Other cranes, by relaying the work, make the kettle readily accessible from every part of the plant and to the shipping tracks.

Fig. 3 is a vertical cross-section through this kettle, and Fig. 2 is a plan view. A cylindrical well 12 ft. in diameter and 32 ft. deep was excavated and lined with a steel shell to exclude ground water. This was lined with insulation to prevent heat losses to the earth. This shell extended 12 in. above the ground level and was surrounded by a concrete platform and curbing to prevent flooding by surface water. A cylindrical steel pitch kettle 7½ ft. in diameter and 40 ft. deep was erected in the center of the pit, and the insulated conical housing shown in Fig. 4 was built to complete the inclosure. Thus an annular heating chamber approximately 2 ft. wide was provided around the entire exterior of the pitch kettle. The removable steel cap that is shown on the ground in Fig. 1, at the left of the kettle, serves to seal the pitch compartment between dips.

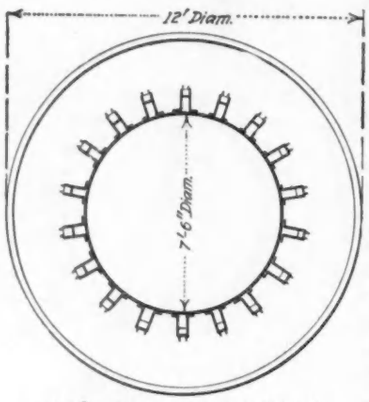


FIG. 2—PLAN OF PIT SHOWING HEATER LOCATIONS

Eighteen special electric heaters, each rated at 11 kw., are placed in this heating chamber, and are suspended and guided by steel hooks engaging steel stirrup straps welded to the wall of the pitch kettle. Each heater is 34 ft. long and is designed with ample provision for expansion and contraction. The energy is supplied at 550 volts, three phase, 60 cycles by the Holyoke Water Power Company. Circular busbars shown in Fig. 4 encircle the top of the kettle, and each heater is connected directly across one phase at 550 volts. The total heater capacity is 198 kw., and the heaters are arranged so that they can be cut off in nine uniformly distributed stages, with perfect phase balance on every stage. As all terminals are at the top, any individual heater can easily be disconnected and hoisted out if repairs are needed. The conical roof is sectional, allowing ready access at any point. Underground cables in conduit connect the heater buses to the main control panel, which is located in an adjacent building. The temperature control instruments have capillary tubing reaching to the interior of the pitch kettle.

Very uniform heating was obtained over the entire surface area of the pitch kettle by spacing the heaters at the proper distance from the shell and by a tapering capacity increasing toward the bottom of the kettle. To stir the pitch thoroughly a series of air jets is located in the bottom of the kettle near the center. Whenever new pitch or volatile oils are added to the kettle, air

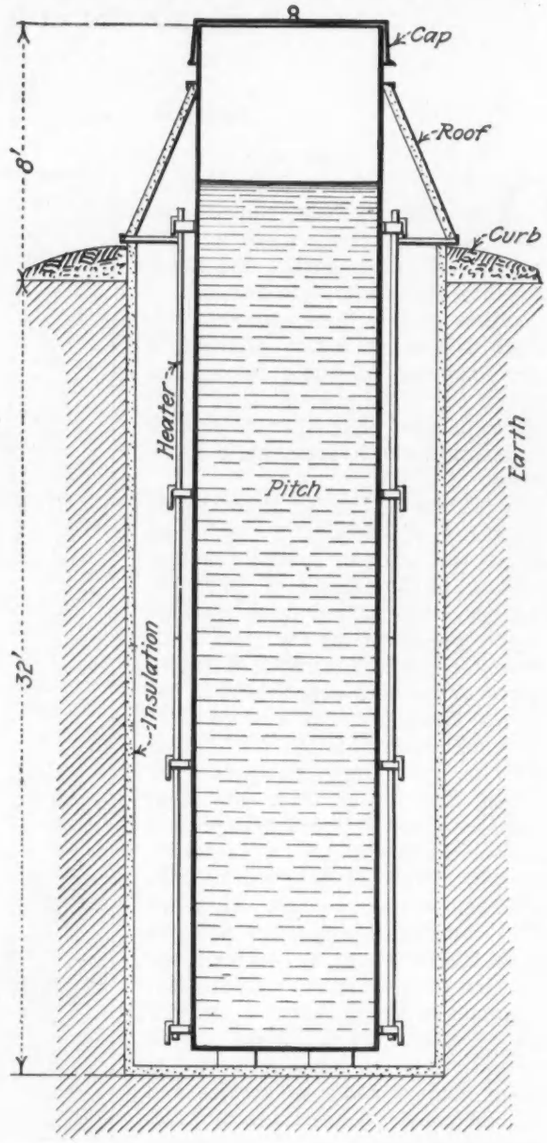


FIG. 3—CROSS-SECTION OF ELECTRIC KETTLE FOR PITCH HEATING

is admitted at 100 lb. pressure per square inch and forces its way upward through the pitch, causing a circulation up the center and down the walls of the kettle. This simple stirring method has proved very effective in maintaining uniform quality of mixture and has entirely prevented the deposit of sludge. It quickly equalizes the heat by thoroughly mixing the new materials with that already in the kettle. The average contents of the kettle is about 7,000 gal. of pitch.

Fig. 1 shows this dipping plant in operation, with a section of steel pipe 6 ft. in diameter and 30 ft. long being hoisted out of the pitch kettle. The work is brought to the kettle by the crane, lowered into the hot pitch and allowed to soak there for the few minutes required to heat the steel up to the pitch temperature.

As the heat absorbed by the metal is a very small part of that stored in the mass of the pitch, it has no appreciable effect on the pitch temperature and the input of heat balances that carried away by the work. After a few minutes' soaking the pipe is hoisted to the position shown in Fig. 1, allowed to drain, and then swung away to be stored in the yard or loaded upon a flat car for shipment. This immersion and removal of work from the pitch also stirs it mechanically.

No Repairs in Eleven Months

This pipe-coating plant has been in constant operation at the Walsh works since early in March, 1925, without a single enforced shutdown. No attention or repairing of any kind has been required to date and apparently the entire equipment is in as good condition as when installed. The actual operating costs have been

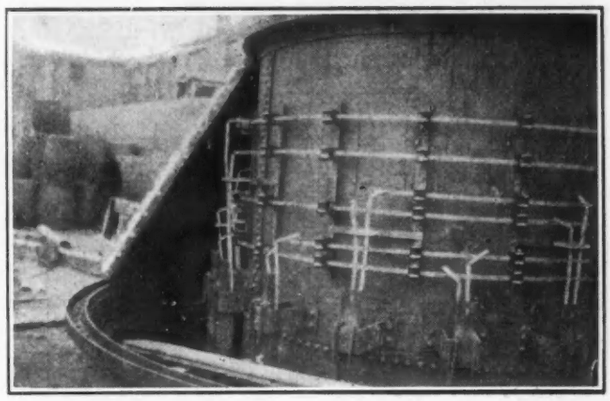


FIG. 4—ROOF OF HEATING CHAMBER AND HEATER BUSBARS

appreciably lower than for a superheated steam plant. There is also a lower investment charge and much lower labor cost. As dipping is a somewhat intermittent process, the saving in cost of attendance is especially important in reducing overhead charges. The excellent insulation prevents waste of heat and the pitch is usually kept hot ready for use. During this year of service no sludge has formed in the kettle, the diffused heating and the uniform mixing having solved this troublesome problem. Another advantage is in having all heaters outside the pitch kettle. The interior is thus entirely free from any obstruction which can collect sludge or be damaged by contact with the work, and it has never been necessary during the eleven-month period to empty the kettle.

Advantages of Electric Pitch Heating

In summary, electric pitch heating has proved practical and economical on a large scale, giving the following advantages over any other method: (1) Lower investment charges; (2) lower operating costs; (3) reduced labor, maintenance and depreciation; (4) greater flexibility and range for meeting dipping specifications; (5) more accurate temperature control; (6) formation of sludge prevented; (7) better quality and more uniform coating on steel; (8) less liability of shutdown; (9) no waste of pitch material.

It is not claimed that electricity is best for every industrial heating process, but often, as in this case, a careful analysis of the problem shows that it not only gives a better product but is cheaper than any other source of heat when the special requirements of each particular problem are properly balanced.

The Meterman and His Responsibilities

Dual Obligations to Company and Public—Training for Future Development Important—Educational Work in Providence

By W. J. Mowbray
Meter Engineer Narragansett Electric Lighting Company, Providence, R. I.

OF ALL central-station employees the meterman holds a unique position of dual responsibility—first to his company, and second to the public to which he is under a solemn and most weighty obligation. On the one hand the company may be imagined as saying to the meterman: "Here is my finished product, the one thing I have to sell—my valuable kilowatt-hours. I intrust them to you. Measure them with the greatest care and see to it that the customer gets the exact number for which he pays." On the other hand, the customer may be thought of as saying: "Here is the key to my cash drawer. I trust you with it. Pay to your company, for me, the exact number of dollars and cents that I owe it."

Thus the meterman is a judge, an arbiter and literally a deputy sealer of weights and measures. Therefore he should develop his character to a fine degree of integrity and cultivate a judicial quality of mind. This means thinking of himself not solely as an employee, but always considering his public obligations and avoiding the temptation at times to favor the company even so little through mistaken zeal.

Character is the first requirement of the meterman. Because the public trusts him with the key to its cash register, he is in honor bound to respect and justify that trust. The central stations of this country are so fortunate as to enjoy the confidence of the public to a high degree. The public trusts them to calibrate accurately and seal the meters without ordinarily having a representative of the public present.

Increasing Need of Technical Training

After character, the next most important requirement in the meterman is thorough technical competence. Meters and accessories have lately grown so intricate and complex that in order to care for them properly a high degree of technical and mechanical skill is needed. Without such knowledge a meterman cannot do good work and despite the best intentions may work a grave injustice to one party or the other.

This leads to the increasing need of technical education for metermen. Many meter department heads are now of the opinion that in hiring new men who are expected to develop into good metermen consideration should be given only to those with a high school education or its equivalent in a mathematical direction. Such care in hiring new men is sure to improve future personnel, but right now we have to consider how to educate many of our men who are deficient in this respect, although they may be good men in other ways.

How shall the companies help these men and thereby help themselves? It is manifestly impossible to send them all to the short courses in meters held at Yale and elsewhere, chiefly because the universities cannot handle so many. Another almost equally strong objection is that these men are not yet prepared to receive

the kind of instruction given by the universities. It is almost useless to send men to these short meter courses who do not know arithmetic thoroughly and who have little knowledge of algebra and physics. By this I do not mean to say that the universities could not educate these men from the ground up; but I do mean that they cannot even begin to do it in the time that the central stations can let the men spend there.

I believe a solution of this important problem has been found in the Providence company, along the following lines:

An educational class is held in the company's auditorium once a week during the college year. The class is called to order about half an hour before regular quitting time, which insures good attendance and makes the men only a little late in getting home. The time is largely taken up in asking and answering questions, and the work that really counts most is home work assigned by the instructor and brought in by the student for correction. The class was started on a specially simplified algebra, and it might be even better to start such a class on arithmetic in order to lay a sound foundation. Electrical instruction will be introduced later as soon as the men are prepared to receive it. These classes are to run concurrently with the public schools and will be continued year after year as needed.

COMPETENT INSTRUCTION NEEDED

The class at Providence is taught by an outside instructor, a man who does this kind of work for a living and is thoroughly used to it. Brown University professors who regularly teach mathematics, physics and electrical engineering are to be employed in the order named as the class advances. In addition, a responsible man in the company's employ exercises control, seeing to it that the attendance does not drop off, that all the men do home work, etc. In regard to expenses, the company pays the professor, whose chief duty it is to lecture and answer questions, and the company also pays an assistant who helps correct the home work. The company further provides suitable quarters for the school, with the necessary benches, blackboards and stationery.

The student buys all his own books and drafting implements on the installment plan at the rate of twenty cents per week. This plan has the advantage that should students drop out, the company is not left with the books on its hands. Further, the student takes more interest in that which costs him something. This class in Providence is only in its first year, yet it gives remarkable promise of success. Practically the entire personnel of the meter department, including the clerical force, attends. In addition, about an equal number of students from other departments are registered, the total membership being about 100. The more advanced students help the backward ones, and this makes the progress of the work easier. It is believed that this course will meet the educational needs of the students and will also serve to prepare men for better work in the short university courses in case it seems desirable to send representatives to these.

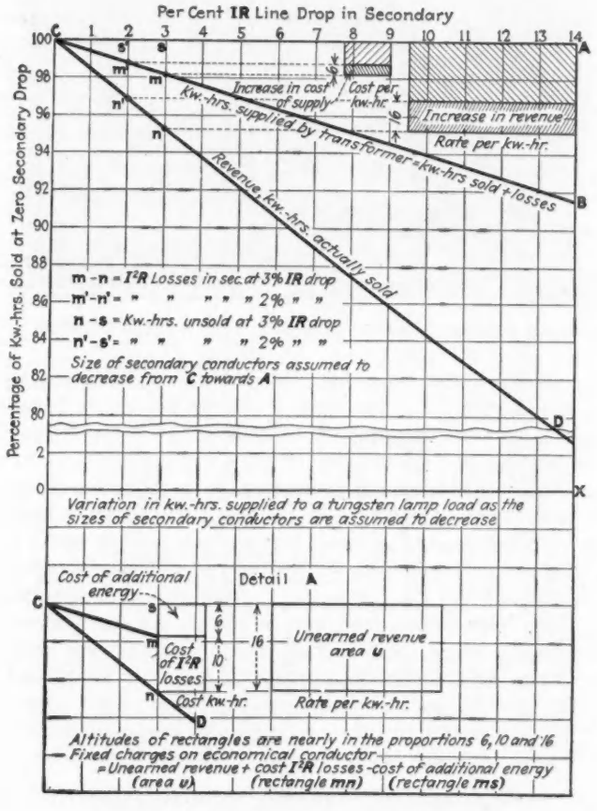
In closing, a word about the university courses that may be helpful to other companies. I believe that these should be attended by more carefully selected men and that it would be desirable to make these courses last a week or two. The scope of the instruction given each year should be restricted in order to avoid trying to cover too big a field. This is being done this spring at Yale, where there will be both elementary and advanced courses. The former will cover only about 70 selected pages in the Meterman's Handbook, and the latter will be confined entirely to vector analysis.

Letters from Our Readers

Economical Wire-Size Calculations

To the Editor of the ELECTRICAL WORLD:

In a letter published in the ELECTRICAL WORLD of May 15, page 1056, Howard P. Seelye calls attention to the relative importance of the cost of energy losses in secondary conductors and "unearned revenue" as defined in an article on "Economical Wire Size for Lighting Secondaries" in the issue of Feb. 27. This


Per Cent IR Line Drop in Secondary
Percentage of Kw.-hrs. Sold at Zero Secondary Drop
Increase in cost of supply
Cost per kw.-hr.
Increase in revenue
Rate per kw.-hr.
Kw.-hrs. supplied by transformer = kw.-hrs sold + losses
Revenue kw.-hrs. actually sold
m - n = I²R Losses in sec. at 3% IR drop
m' - n' = " " " " " 2% " "
n - s = Kw.-hrs. unsold at 3% IR drop
n' - s' = " " " " 2% " "
Size of secondary conductors assumed to decrease from C towards A
Variation in kw.-hrs. supplied to a tungsten lamp load as the sizes of secondary conductors are assumed to decrease
Cost of additional energy
Detail A
Cost of I²R losses
Unearned revenue area u
Cost kw.-hr.
Rate per kw.-hr.
Altitudes of rectangles are nearly in the proportions 6, 10 and 16
Fixed charges on economical conductor
= Unearned revenue + cost I²R losses - cost of additional energy
(area u) (rectangle mn) (rectangle ms)

DIAGRAMS FOR CALCULATING COST OF LOSSES

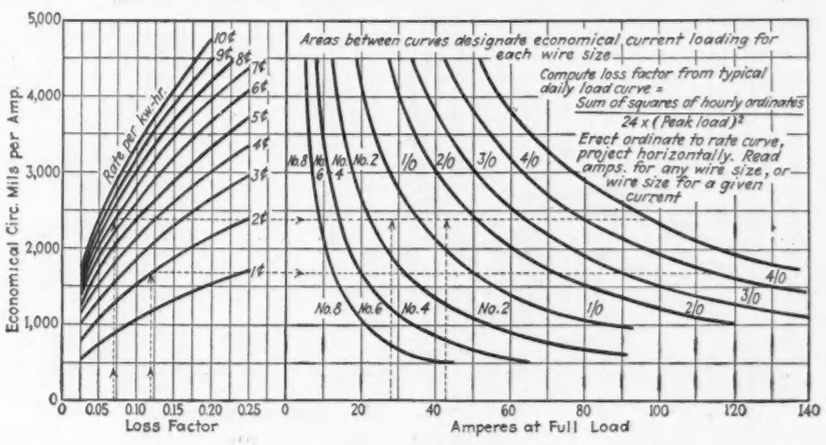
refers to the decreased watt consumption of tungsten lamps when burned at less than normal voltage owing to line voltage drop. It was proposed to use this loss in revenue as a factor in calculating the economical size of secondary conductors. In the original circuit cost equation most economical conditions were assumed when the sum of fixed charges on the secondary wires, cost of I^2R line losses and unearned revenue was a minimum. A simplified working formula was then developed in which unearned revenue was set equal to the fixed charges, without using the term for I^2R losses. As Mr. Seelye points out in his letter, these losses are relatively important on a kilowatt-hour basis. The following detailed description shows how due allowance is made for the cost of losses in the approximate method.

Consider a lighting secondary supplied from a transformer at the regulated primary load center at constant rated lamp voltage. If the consumer's meter were located at the transformer terminals, 100 per cent revenue would be derived from the lamps. If the meter is at the end of a secondary main, the revenue kilowatt-hours sold vary as the 1.6 power of the supply voltage because the secondary wire size and *IR* drop are assumed to vary (curve *CD* in the diagram). Adding the I^2R losses in the secondary gives curve *CB*, which is drawn to the 0.6 power of the voltage. Line *CA* represents 100 per cent revenue kilowatt-hours. Taking the example used by Mr. Seelye, the kilowatt-hours sold at 3 per cent drop are proportional to the height of the ordinate at *n*, or 95.3 per cent; the I^2R secondary line losses to the length *mn*, and the kilowatt-hours unsold because of line drop to the length *ms*. If the wire size is increased so that the *IR* drop is reduced to 2 per cent, the loss is reduced to *m'n'*. The increase in kilowatt-hours unsold is proportional to the altitude of the rectangle projected from the points *n* and *n'*. The additional energy which must be supplied at the transformer is only the amount represented by the vertical distance between *m* and *m'* as indicated by the altitude of the smaller rectangle. That is, for a gain of 16 kw.-hr. in energy sold only about 6 kw.-hr. additional energy is required. This is due to the increased efficiency of the larger secondary copper. If the bases of the rectangles are drawn proportional respectively to the retail rate per kilowatt-hour and cost per kilowatt-hour of energy delivered at the transformer, the areas are proportional to the additional revenue and energy cost. The net increase in revenue will be the difference in areas.

In the formula the unearned revenue up to the 100 per cent line *CA* is used, as illustrated in the detail at the bottom of the diagram. The cost of additional energy, to be deducted from unearned revenue, is indicated by rectangle *ms*. The cost of I^2R losses is given by the area at *mn*. Most economical conditions are assumed when the fixed charges on copper = (unearned revenue minus the cost of supplying the additional energy) + (the cost of actual I^2R losses in the secondary). This is proportional to area *U* minus rectangle *ms* plus rectangle *mn*. That is, at the economical voltage drop the fixed charges on copper equal the unearned revenue plus the difference between the cost of I^2R losses and the cost of the additional energy that would be required at 100 per cent voltage. For a small percentage drop this is nearly equivalent to adding one-fourth the cost of energy per kilowatt-hour to the retail rate per kilowatt-hour. But for the ordinary run of practical problems the unearned-revenue item alone gives reasonable accuracy, the approximation tending to reduce slightly the calculated wire size. Where a calculated result lies midway between two wire sizes preference may be given to the larger. This gives a practical method for figuring economical wire sizes directly from kilowatt-hour rate, due weight being given to the cost of losses without the necessity for evaluating the exact cost of energy.

It should be noted that these figures apply to kilowatt-hours over a yearly period. The proportionate relationship between *IR* drop, I^2R losses and unsold kilowatt-hours is maintained for any load factor and loss factor and in problems involving distributed load. The formula makes allowance for primary line and transformer drop. Power factor close to unity is assumed in this calculation.

In order to show the effects of different rates on economical wire size, a diagram is given here with curves for rates from 1 cent to 10 cents plotted against loss factor. This may be used as a practical working diagram for 115/230-volt lighting secondaries. Wire-size curves are plotted at the right against ampere load. Areas between curves represent economical range of current loading for wire sizes in common use. The curves at the left were obtained by computing economical circular mils per ampere for each rate and loss factor by means of the wire-size diagram in the issue of Feb. 27, 1926 (page 451; Fig. 4). Two dotted horizontal lines are shown, the upper representing typical residential lighting at 7 cents per kilowatt-hour and loss factor 0.07. This applies equally well to a 10-cent rate at loss factor 0.05 or to a 5-cent rate at loss factor 0.10. The lower dotted line is typical of industrial lighting at a low wholesale rate of 2 cents and loss factor 0.12. Intersections at the right indicate that it pays to install larger wires and give better regulation to consumers paying full retail rates. The unearned revenue formula thus provides a logical differentiation between classes of service with varying characteristics.



EFFECT OF DIFFERENT RATES ON ECONOMICAL WIRE SIZES

The diagram is drawn for tungsten-lamp load concentrated at the end of the secondary. Exact calculations for distributed loads are more complicated. As an approximate working rule it may be sufficiently accurate for load uniformly distributed over four-pole to ten-pole sections to choose the wire size indicated by an ampere load two-thirds of that supplied to the secondary at the transformer. To illustrate, a 10-kw. transformer supplies 43 amp. at 230 volts. For concentrated residential lighting the diagram indicates No. 1/0 wire with No. 2 neutral. For uniformly distributed load the size would be determined at $\frac{2}{3} \times 43 = 28.7$ amp., which gives No. 2 as economical for outside wires with No. 4 neutral.

H. S. LITCHFIELD,
Providence, R. I. Electrical Distribution Engineer.

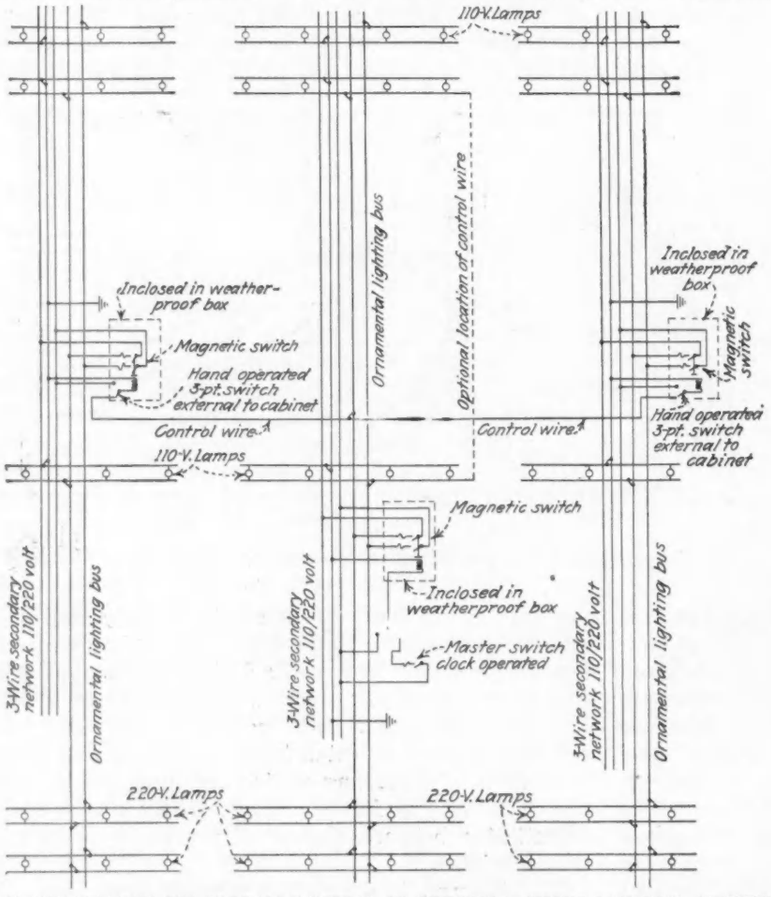
Central Station and Industrial Practice

Cascade Control for Street Lights

THE major part of the ornamental lighting system in the Denver business district is a multiple system and was installed piecemeal over a period of twelve years from 1906 to 1918. Service was supplied to these lamps by the Public Service Company of Colorado from the secondary lighting network, and the various circuits were controlled by 125 small knife switches located at the alley on each street. Considerable time was required each day to turn the lights on and off, resulting in irregular burning hours, and frequently lamps would be burning during daylight hours because of neglect on the part of new patrolmen.

In order that all lamps should be kept burning on scheduled time it was necessary to have some lamps burning ahead of or later than schedule as much as 30 to 45 minutes. The labor and excess energy cost under this scheme of operation amounted to fully $1,000 annually, so it was found advisable to develop a cascade switching arrangement. The present cascade control system was installed about three years ago at a cost of approximately $5,000.

The details of connections are shown in the accompanying figure. The contactors employed are General Electric C. R. 7002 mounted in an iron box to make the installation reasonably weatherproof. The three-point snap switch installed at each contactor is utilized for throwing on the circuit in the event of failure of the supply to the previous contactor, which would de-energize the control wire, or failure of the control wire or contactor. The system as such has worked perfectly, the only need for the use of the snap switches having arisen as a result of failure of supply to one section of the system and an incorrect connection of one control wire at the time some work was done in rearranging the secondaries.



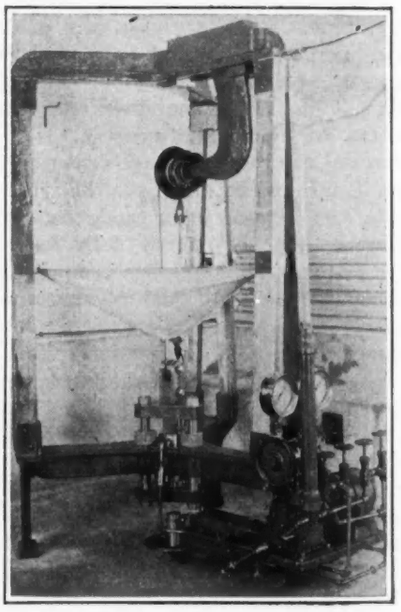
WIRING DIAGRAM FOR CASCADE CONTROL OF MULTIPLE STREET-LIGHTING CIRCUITS

Insulator Testing Machine

By JOHN J. HANLON
Corvallis, Ore.

A TESTING machine of a mechanical-electrical type which simulates the conditions resisted by an insulator in service on a transmission line by withstanding a load comparable to the weight of the line as well as the electric potential has been constructed in the Oregon State Agricultural College electrical engineering laboratory for use in insulator testing.

The novel feature of the machine is that it is so constructed that mechanical load and electrical potential can be applied to the specimen simultaneously. A mechanical load of 50,000 lb. can be obtained by means of a ram operated by oil from a high-pressure pump. Potential up to 500,000 volts can be applied to the test specimens when placed in the machine.



TESTS INSULATORS MECHANICALLY AND ELECTRICALLY AT SAME TIME

Combined mechanical - electrical tests are made by applying mechanical tension by increments of 2,000 lb. per minute, while constant voltage 25 per cent below flashover point is maintained. The point at which a specimen fails, either electrically or mechanically, is the ultimate service strength of the insulator.

Keeping Distribution Maps Up to Date

BY JOHN KRAMARCSIK
Distribution Department, Connecticut Light & Power Company, Waterbury, Conn.

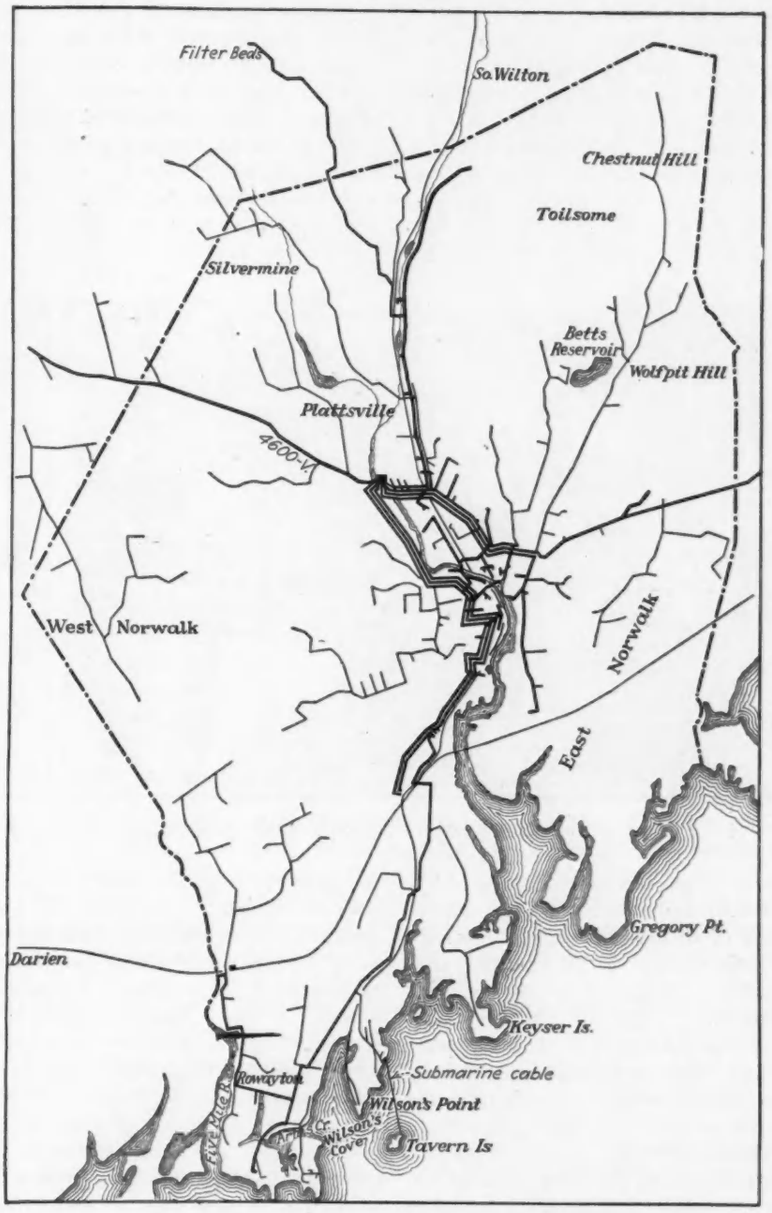
FOR the proper and efficient operation of any distribution system a certain minimum amount of circuit information is absolutely necessary. This information is usually kept in the form of maps, the nature of which may vary from a simple line diagram to complicated groups of sectional maps showing everything from the pole location to which side of the crossarm carries the circuit. A system of maps such as the last mentioned can very easily become extremely cumbersome, so it has been the practice of this company to provide separate record routines for its transformers, poles and the equipment thereon. To the maps is left the problem of showing distribution circuits, their character and extent.

The circuit maps that we formerly used were classified into two main groups: Those showing the circuits superimposed on a geographical map in colors, and the conventional sectional circuit maps. At the time such maps were made they were very useful; but this period of usefulness did not last very long, the main reason being the difficulty of showing circuit changes. The result was that soon the maps were out of date and therefore practically useless.

The colors, which showed the circuits plainly, proved to be a hindrance when it came to showing such changes as cutovers from one circuit to another, for when a section of circuit was cut over it changed its identity, and in order to show its new character it was necessary to recolor the section. This was feasible enough, but the continual change soon made a very "messy" looking record.

The sectional maps presented many other problems besides those involved in changes. In order to gain a comprehensive picture of a complete circuit under this system it is usually necessary to match up a number of sections, which is not always convenient or easy to do. A decided disadvantage of the sectional system of circuit mapping is that sectional maps showing only one circuit give absolutely no information as to the position of the circuit in question in relation to other circuits in the immediate vicinity. This fault alone when not watched carefully may allow circuits to grow into proportions quite inconsistent with good distribution practice, hindering good regulation and thereby contributing to poor service. Taken as a whole, our former methods of circuit mapping were neither clear nor simple. Condensation and simplification of circuit records had to be achieved.

To accomplish this a circuit survey of each of our districts was made separately. The territory of this company is divided into districts, each having its own operating department, which works in conjunction with the general engineering office. When these surveys were completed, the data were plotted on cloth geographical maps of the territories under consideration. These cloth maps have been prepared from sections of government topographical maps. A standard scale of 833⅓ ft. to the inch was adopted for these linen tracings made from exploded maps, which hereafter will be referred to as master maps.



TYPE OF CIRCUIT SHOWN BY LINE WIDTH

The plotting of the data on the master maps was done in the following manner: A line approximately ¼ in. wide was used to represent a three-phase distribution line and a line one-half that width was used to represent a single-phase distribution line. This simple classification was possible because of our almost complete standardization on three-phase

and single-phase distribution. A few existing two-phase lines were shown as three-phase but labeled clearly to show their true character. This was done because of their contemplated change to three-phase in the near future. All underground circuits, or those portions of any circuit underground, were shown with a broken line. Black ink was used for all plotting.

After a master map was completed it was photostated. The negative, or black print, so obtained was then rephotostated, producing a fine white miniature (18x22 in.) of the large master map. Although the master maps vary as to size, the photostat machine was adjusted to make prints of a uniform size. This size is large enough to give plenty of details and small enough to enable copies of the master map to be kept in book form. It is realized that situations may arise where this photostatic copy of the complete master map will not answer all needs. In such cases a separate photostatic copy can be made covering only the section served by the circuit in question. If this is not sufficient, paper prints of the same size as the master maps can be used and the circuit plotted thereon if detailed study is necessary such as locating transformer positions, etc.

After the master maps are photostated, copies are sent to each district, each district receiving only photostatic copies of the master maps showing the local circuits. Upon the receipt of these replicas of the master maps by each district the local staff becomes responsible for keeping its copies up to date. Upon the execution of any work order involving changes or extensions to the primary distribution system the exact nature of these changes or extensions is immediately indicated in crayon on the photostatic copies in the possession of the district. Periodically each district is required to send its copies to the office of the distribution engineer in the general engineering office of the company, where the master maps are then brought up to date. After all corrections have been made the master maps are again photostated and new white photostatic prints are made to replace all the superseded sheets.

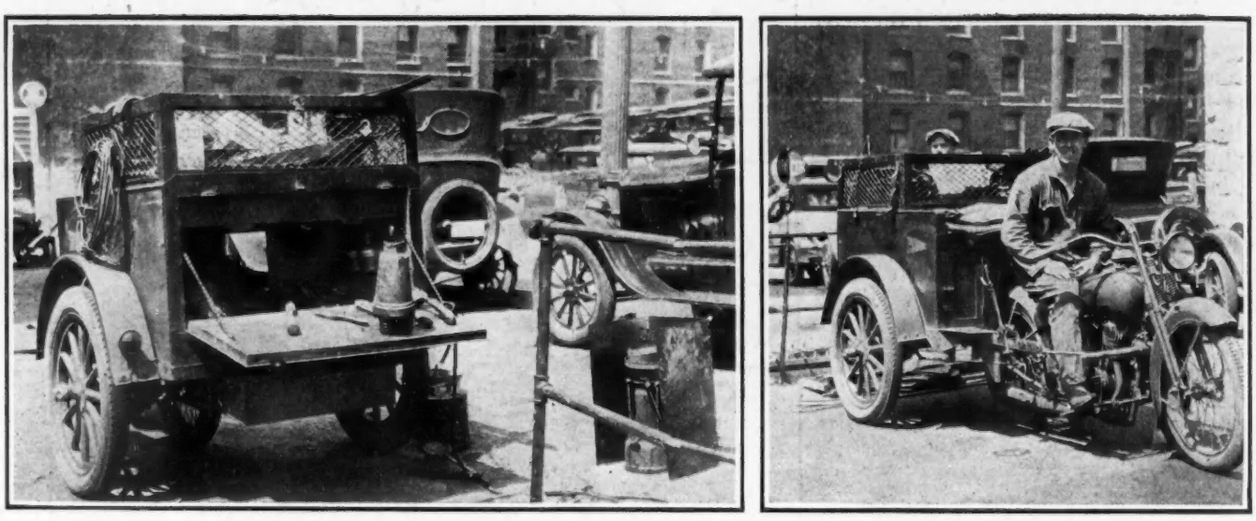
In its entirety the system is very flexible, changes being very easily made. The fact that all circuits are in one color makes it easy to open a line at one point and close it in at another. Also when the termination point of the three-phase service is extended, it is a simple matter to widen the line. The cloth on which the plotting is done is of a very heavy body with plenty of filler, thereby providing a surface that can be reworked a number of times without damage. The master maps receive very little handling and consequently should last a long time. Because of the ease with which it is possible to make copies of the master maps, a more liberal distribution of circuit information can be made than under the old methods where one map had to serve the demands of everyone who desired information concerning the circuits plotted upon it.

In sum, the system makes it possible properly to handle circuit data, distinguish the different elements of a problem, and appreciate their true significance with a minimum expenditure of time and effort.

Motorcycle Cart for Cable Splicing

BY G. A. RILEY
Assistant Superintendent Electric Distribution, Los Angeles Gas & Electric Corporation

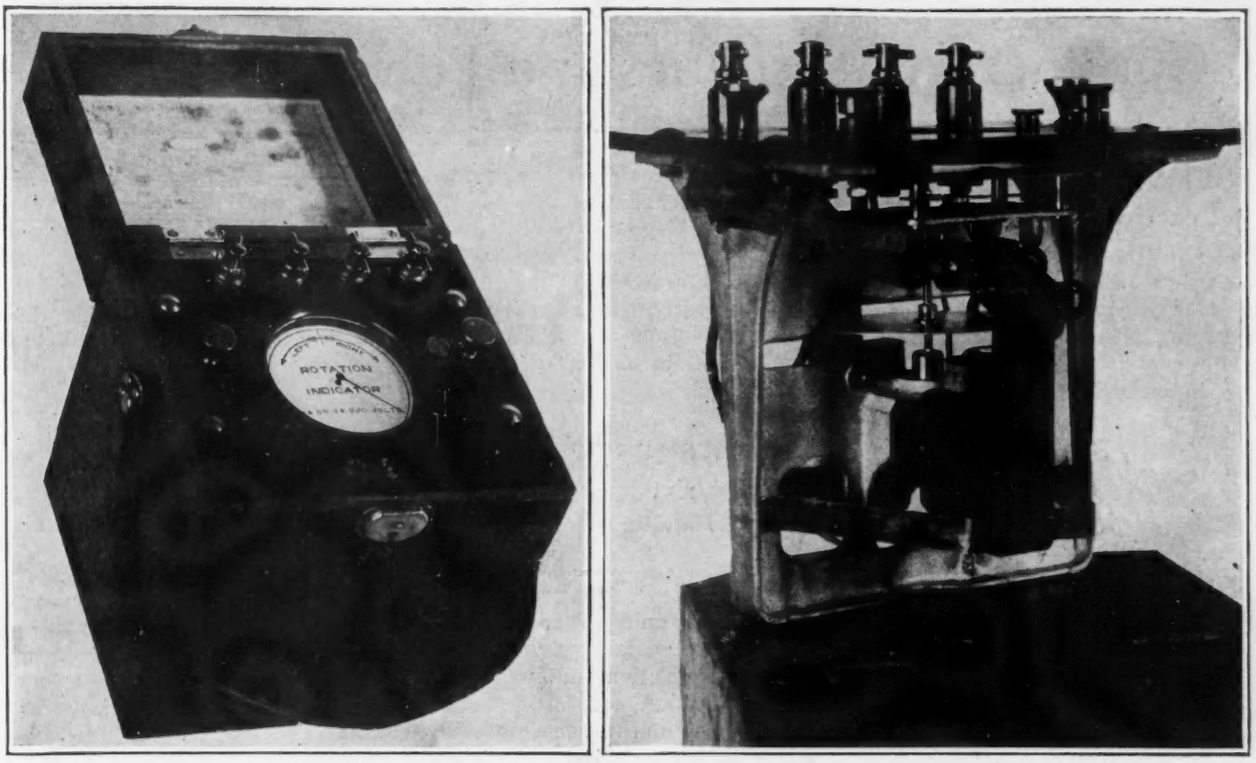
CABLE splicing and maintenance work have been greatly facilitated in the conduit districts on the system of the Los Angeles Gas & Electric Corporation, in the city of Los Angeles, by the use of the special motorcycle splicing cart shown in the accompanying illustrations. This type of equipment has been in use by this company since 1917, twelve such carts being in service at the present time.



MOTORCYCLE CABLE-SPLICING CART USED FOR MAINTENANCE WORK IN LOS ANGELES

Standard twin-cylinder motorcycles are purchased and the rear car is manufactured and fitted to the motorcycle, according to the company's specifications, by a local concern. Two passengers are carried on a seat just back of the motorcycle rider, thus furnishing transportation for the entire splicing crew, as well as for a complete set of splicing tools, material for the day's work and a small amount of emergency material. The rear car is mounted on a vanadium-steel axle and standard 30-in. x 3½-in. Ford wheels, the whole having a capacity of about 750 lb., exclusive of the box.

This outfit has proved very satisfactory for both near and outlying conduit districts, some of which are as far as 7½ miles from the shop. The total cost of the motorcycle and rear car is approximately $725.



TEST METER CONVERTED INTO PHASE ROTATION INDICATOR BY ADDITION OF 220-VOLT WATT-HOUR SHUNT ELEMENT
Left, completed instrument. Right, instrument removed from case showing shunt element

Rotation Indicator Made from Wattmeter Parts

BY L. G. WAINMAN
Electrical Inspector El Paso Electric Company, El Paso, Tex.

AN EASILY constructed and inexpensive phase rotation indicator made from watt-hour meter parts has been found indispensable by the El Paso Electric Company for determining phase rotation in changing over customers from two-phase to three-phase service. The instrument, which is shown in the accompanying illustrations, was made from an old rotating standard, to which was added the shunt element out of a 220-volt watt-hour meter. The arrangement is shown schematically in Fig. 1.

The method of using the rotation indicator is very simple and can be understood and used by any lineman after a few minutes' explanation. It has proved invaluable where it is necessary to replace existing two-phase or Scott-connected banks with delta- or Y-connected three-phase banks. The connections used when a phase changer is employed to supply temporary three-phase service are shown in Fig. 2.

To phase out two three-phase transformer banks all that is necessary is to connect instrument leads Nos. 1 (2 and 3) and 4 to the leads from the working bank and give them numbers corresponding to the instrument leads and observe the direction of rotation. Then connect the leads from the new bank in such a way that the direction of rotation will be the same and give the leads numbers corresponding to the numbers on the instrument. When the change is made, transformer leads connect to similarly numbered secondary wires.

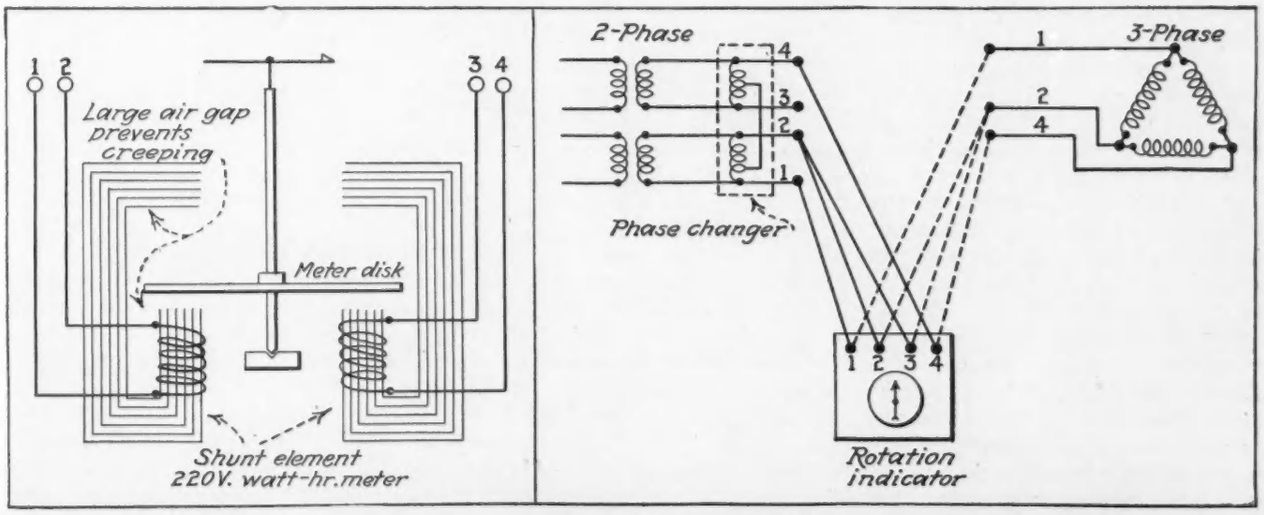


FIG. 1 (LEFT)—SCHEMATIC DIAGRAM OF PHASE ROTATION INDICATOR. FIG. 2 (RIGHT)—CONNECTIONS FOR CHECKING ROTATION BETWEEN TWO-PHASE AND THREE-PHASE TRANSFORMER BANKS WHERE A PHASE CHANGER IS USED

Commercial Activities and Public Relations

Electric Refrigerator Practices at Rockford

BASED on monthly readings of separate check meters serving 94 domestic refrigerators for a period of twelve months, the refrigerators having capacities of 6, 10, 14, 20, 30 and 40 cu.ft., the Rockford (Ill.) Electric Company finds that the average energy consumption is 74.2 kw.-hr. per month, or 890.4 kw.-hr. per year. Figured on the 3-cent portion of the sliding-scale rate, this consumption gives an average yearly revenue of $26.71 per installation. By enlisting the ice cream manufacturers and dealers of Rockford in a rental and resale plan, the company will connect 300 electric ice cream cabinets this year, returning an average annual revenue of $30 apiece.

D. L. Cash, commercial manager of the Rockford company, declares that all makes of domestic refrigerators now on the market are attractive in appearance and afford adequate varieties of types, capacities, models and finishes to permit the most attractive sales set-up. For five reasons, however, the company sells a sulphur-dioxide machine. The reasons are: (1) Low operating pressure; (2) pungent odor discloses leaks before food spoilage occurs; (3) service man can quickly locate leak with an ammonia swab; (4) lubricating qualities of refrigerant permit operation if oil becomes exhausted; (5) thermostatic rather than pressure control.

Remote installations (compressor installed in basement) are favored by the Rockford company. For apartment houses, multiple installations cost less, but the company prefers and sells individual machines, either self-contained or with basement compressors. Multiple installations impose a heavy constant duty on one compressor and greatly increase the servicing possibilities, Mr. Cash contends.

By proper installation of the refrigerators, the Rockford company has been able to keep its service calls down to one every eighteen months per machine. The installation and service men are schooled in refrigerator practices before being put out on the job.

List price is maintained and $60 is added for installation, anticipated service and inspection calls. Deferred payments spread over twelve months are afforded by adding 10 per cent to the cost installed for carrying charges. However, it has been found possible to secure 80 per cent of the business on cash at the time of installation or after 30 days.

A small stock of two well-known refrigerators is carried in oak, and also in white and gray porcelain. List prices are maintained on the boxes, which are not sold, however, except with refrigerating units.

Advantages of Electric Tractors in Industry

Industrial Electric Trucks Efficient in Cutting Cost of Material-Handling Operations—A Profitable Load for the Power Company

INDUSTRIAL electric trucks and tractors are rapidly demonstrating their economy in labor saving and increased production in manufacturing plants. A careful estimate of the number of these machines in use in this country places the total at approximately 15,000. Keen competitive conditions and increasingly expensive unskilled labor largely account for the greater interest recently taken in modern methods of material handling.

Although some central-station companies still hestitate to push this class of equipment, desirable as it is as an off-peak load builder, others are seeking information that will enable them to understand the possible applications of the electric truck.

Industrial electric trucks may be divided into five general types with respect to their construction to meet different applications; the straight platform truck, the elevating platform truck, the high lift truck, the crane truck and the load-pulling type or tractor. In addition to these five major types of storage battery haulage and handling equipment, several other adaptations for special jobs have been developed.

The field for the storage battery industrial vehicle as compared with the entire range of material-handling activity is limited only to the extent that in some operations, where there is a continuous flow between two fixed points, power-driven conveyors or elevators, cranes or hoists, pneumatic or gravity systems demonstrate greater economies than can the mobile unit.

COST PER HOUR FOR OPERATING INDUSTRIAL ELECTRIC TRACTORS AND TRUCKS

Industry	Tractor	Straight Platform	Elevating Platform	High Lift	Crane
Automobile	$0.40 to 0.50	.....	$0.40 to 0.50	$0.40 to 0.50	$0.40 to 0.50
Tin plate	.....	.....	.....	0.30*	.....
Marine terminal	0.38	0.48	.....	0.43	0.65
Leather	0.41	Different plants	0.62	.....	.....
Brass plant	.....	.....	0.24†	.....	.....
Meat packing	0.60	.....	.....	.....	.....
Rubber	0.39	.....	0.30	.....	.....
Warehouse	0.34 to 0.40	.....	0.40	.....	.....
Aluminum plant	.....	.....	.....	0.30	.....
Freight house	0.55	.....	0.55	.....	0.55

* No depreciation or interest.
† Does not include power.

What Equipment Costs to Operate

Both to power salesmen and to prospective user no consideration in connection with this equipment is of greater importance than that of operating costs. Such data are scarce as yet, the complete picture being possessed by users only very rarely. For that reason the figures given below are incomplete. On the other hand, they represent solid facts in the cases cited.

To be complete, costs should include the following items for truck, battery and charging equipment: Interest, depreciation, insurance, taxes, power, maintenance and incidental garaging expenses wherever involved. Interest at 6 per cent, taxes and insurance at 2 per cent, lead battery life three and one-third years, nickel-alkaline battery life five years, truck life seven to ten years, charging equipment life fifteen years, power one and one-half to three cents per kilowatt-hour—

this basis can be generally applied in figuring costs. The question of maintenance is involved, including spare parts, lubricants, tires and labor, fluctuating with the type of service and the amount of attention devoted to regular upkeep. Costs per hour of operation for the various types of equipment in different industries on the basis of 300 working days of eight hours are shown in the accompanying tabulation.

The statement of savings only in terms of men released conceals many sources of increased revenue growing out of the use of the electric industrial truck. These include:

1. Decrease in labor turnover through making working conditions more agreeable and taking the backache out of heavy handling jobs.
2. Increase in effective storage and manufacturing area through elimination of congestion made possible by rapid movement of heavy loads.
3. Decrease in warehouse insurance charges where storage is either on skids or trailers.
4. Simplification of inventory, where skids and containers are used, eliminating waste of time formerly required to make an annual check-up.
5. Elimination of time wasted formerly by skilled operators kept waiting for work or to have finished jobs taken away.
6. Decrease in the stock necessarily held on hand through increased speed in moving it through.
7. Periodic service in usual jobs where the application makes it unnecessary to take a large number of men from other jobs to help out in an emergency.
8. Adherence to production schedules and elimination of shutdowns to smooth out congestion formerly created by inadequate facilities for trucking.

Courtesy Card Aids Customers in Establishing Credit

FEELING that the central station has a wonderful opportunity to cement good will when a customer leaves its territory, utilities of the Rocky Mountain region purpose to issue to customers whose relations with the company have been satisfactory a courtesy card, which will serve to introduce the customer to some other utility and aid him in establishing credit. The accompanying panel shows a tentative draft of the proposed card.

City.....Dated.....192

INTRODUCING

Mr. .....

To ASSOCIATED UTILITIES IN COLORADO, WYOMING and NEW MEXICO

Appreciating the fulfillment of those obligations considered the standard by which business integrity and satisfactory customer relations are measured, we feel justified in presenting a past customer to the Associated Utilities in the Rocky Mountain Division.

(Name of Company)

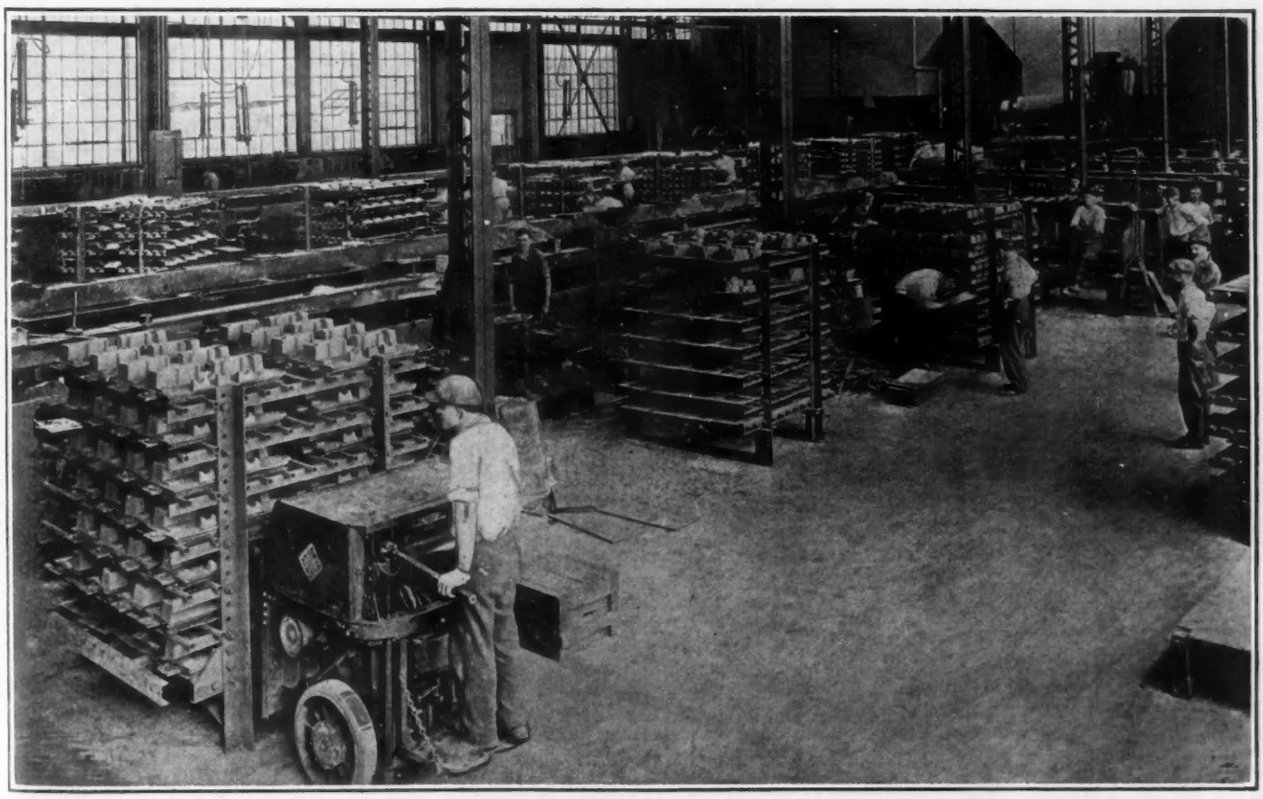
By.....

At the option of the central station to which such a courtesy card is presented, it may be accepted in lieu of other forms of credit reference. It is felt that if all the associated companies in the Rocky Mountain region will participate in the idea and make the adoption of a standard form of card universal, better public relations will result.

Energy Consumption of Rural Customers

RURAL customers in Alabama on Dec. 31, 1925, were using at the rate of slightly more than 1,000,000 kw.-hr. per year, according to a paper presented at the Southern Rural Electrification Conference recently by E. C. Easter, agricultural engineer of the Alabama Polytechnic Institute. Of this amount, 453 farmers were using 33.1 per cent, 95 community enterprises 31.1 per cent and 1,332 non-farming residents 35.8 per cent. Of the energy (not including community enterprises) used by individual customers, 95 per cent was being used in the homes and 5 per cent as farm power.

Of the energy used in the homes a little more than 50 per cent was used by 158 range customers and the



AN INDUSTRIAL TRACTOR MOVING MATERIAL IN PROCESS OF MANUFACTURE

TABLE I—ELECTRICAL ENERGY USED BY RURAL CUSTOMERS IN ALABAMA

Line No.	Project	Date Completed	Customers Dec. 31, 1924	Customers Dec. 31, 1925	*Average Kw.-Hr. Per Customer per Month 1924	*Average Kw.-Hr. Per Customer per Month 1925	Total Annual Kw.-Hr. Used 1925	Per Cent Used by Farms 1925	Per Cent Used by Community Enterprises 1925	Per Cent Used by Other Rural Customers
1	Whitesburg Pike	June, 1920	12	13	78.0	88.0	61,200	17	83	00
2	Eden	July, 1920	39	43	25.0	29.0	15,400	25.8	00	74.2
3	Big Cove Pike	June, 1922	5	5	178.0	189.0	13,547	33	00	67
4	Meridianville Pike	Aug., 1922	9	9	76.0	93.0	33,120	35	65	00
5	Chase Nursery	Aug., 1922	1	1	410.0	480.0	5,760	00	100	00
6	Pickett Springs	Aug., 1922	3	3	20.0	22.2	577	98.5	00	1.5
7	Carter Hill Road	Nov., 1922	12	15	35.4	39.6	6,356	5.0	58	37.0
8	Anniston Pike	Dec., 1922	5	5	26.3	49.9	4,038	63.0	00	37.0
9	Marion Junction	Dec., 1922	51	51	19.2	20.3	12,441	22.0	00	88.0
10	Oakwood School	May, 1923	6	8	43.0	43.5	49,838	13.0	87	00
11	Hinkle Line	Aug., 1923	2	2	90.0	134.5	3,228	100	00	00
12	Narrow Lane Road	Aug., 1923	10	12	121.0	157.0	17,424	22.0	00	78
13	Shades Mountain	Nov., 1923	88	136	75.3	83.5	116,070	3.2	00	96.8
14	Bingham Line	Dec., 1923	2	2	50.0	55.0	2,032	90.0	00	10.0
15	Shocco Springs	June, 1924	15	15	40.0	50.0	7,847	13.7	00	86.3
16	Gardendale	July, 1924	69	89	21.8	26.6	23,849	62.5	00	37.5
17	Five Points	Sept., 1924	67	80	15.1	20.6	51,111	8.6	70	21.4
18	Fulton Springs	Oct., 1924	55	88	26.0	31.0	27,678	7.5	00	92.5
19	New Merkle	Oct., 1924	47	72	20.7	24.6	23,157	11.7	56	32.3
20	Washington Ferry Road	Oct., 1924	6	6	15.3	14.8	957	45.5	00	54.5
21	Watson Line	Oct., 1924	1	2	30.0	37.5	1,803	38.4	00	61.6
22	Huffman	Nov., 1924	9	152	94.0	31.0	57,353	49.0	00	51.0
23	Oak Grove	Nov., 1924	41	74	11.4	47.8	34,469	44.5	00	55.5
24	Agricola Line	Nov., 1924	2	2	356.0	687.5	22,833	82.0	00	28.0
25	Lock 12 Road	Dec., 1924	16	16	30.0	34.2	6,258	63.5	00	26.5
26	Hueytown	Dec., 1924	87	204	21.2	26.2	46,634	4.9	00	95.1
27	Fair Line	Dec., 1924	1	1	75.0	83.0	995	100	00	00
28	Sylacauga Line	Dec., 1924	17	17	36.0	40.5	6,666	84	00	16.0
	Total		678	1,123	34.0	57.0	642,491	22.1	39	38.9

*Average kilowatt-hours per customer per month do not include community enterprises.

remainder by the 1,521 lighting customers. The energy used by the range customers included that for cooking, lighting, all small household appliances and motors not larger than 1 hp., and the energy used by the lighting customers also included small household appliances and motors not larger than 1 hp. Table I gives the rural projects that were completed prior to Dec. 31, 1924, with the average number of customers and the average energy consumption per month per customer for 1924 and 1925.

The 28 projects at the time of completion consisted of 78.1 miles of line, but extensions to the original lines by Dec. 31, 1925, had brought the total up to 108 miles. The average energy consumption per customer per month in 1924 was 34 kw.-hr., whereas in 1925 it had increased to 57 kw.-hr. This does not include any energy used by community enterprises. A study of the original customers connected to the lines shows that the consumption of these customers was higher than 57 kw.-hr.

A complete classification of the 379 farms on the lines Dec. 31, 1925, is given in Table II, with the average and maximum annual energy consumption for each class. The largest farm consumer for 1925 was the Agricola dairy farm near Gadsden, Ala., which used a total of 13,500 kw.-hr. at the dairy and in the house. Of the total, 6,860 kw.-hr. was used for milking 60 cows, pumping water for the dairy and the house, grinding feed, refrigeration for the dairy and a small motor in the farm shop. For lighting the dairy 1,030 kw.-hr. was used, and in the house 5,600 kw.-hr. was used for lighting, cooking, refrigeration and small household appliances. The average for eight poultry farms was 2,640 kw.-hr. per year, even higher than the average for the dairies, but the largest poultry farm consumer used only 4,329 kw.-hr. This indicates that the dairies have a greater capacity for using electric power, but electricity for some uses is more essential for the poultryman. Therefore there is less variation in the amount of energy used by the poultry farm than by the dairy.

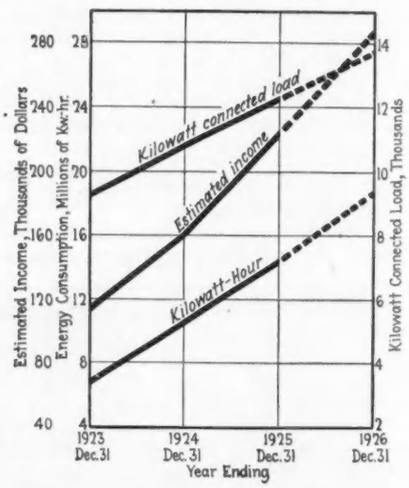
TABLE II—DISTRIBUTION OF ENERGY CONSUMPTION FOR DIFFERENT CLASSES OF RURAL CUSTOMERS

	Number Customers	Annual Kw.-Hr. Used	Average Annual Kw.-Hr. per Customer	Annual Kw.-Hr. for Largest User	Per Cent Total Customer	Per Cent Annual Kw.-Hr.
General farms	178	138,800	780	3,840	7.4	13.00
Cotton farms	74	16,800	240	1,680	3.9	1.50
Truck farms	62	14,900	240	600	3.3	1.40
Dairy farms	41	93,250	2,280	13,500	2.18	8.70
Poultry farms	8	21,120	2,640	4,320	0.43	2.00
Stock farms	1	1,803	1,803	1,803	0.05	0.15
Pecan orchards	3	900	300	450	0.15	0.08
Strawberry farms	7	Not available	(Connected in December)		0.35	....
Nurseries	2	6,360	3,180	5,760	0.10	0.60
Greenhouses	2	1,128	564	785	0.10	0.15
Hay farms	1	Not available	.....	.....	0.05	....
Total classified	379	295,061	800	.....	20.1	27.8
Farms not classified	74	*59,200	800	.....	3.9	5.3
Total farms	453	354,261	800	13,500	24.0	33.1
Gins	6	172,161	28,693	47,463	0.25	16.1
Gristmills	3	7,712	2,542	4,410	0.15	.7
Boarding schools	4	115,667	28,917	37,200	0.20	10.8
Schools, churches and lodges	81	14,356	178	1,863	4.30	1.8
Waterworks	1	21,528	21,528	21,528	0.05	2.4
Total community enterprises	95	331,424	3,200	47,463	5.00	31.1
Other rural customers	1,332	384,000	290	11,265	71.00	35.8
Grand total	1,880	1,069,685	750	.....	100	100

*Estimated.

Boston Industrial Heating Load Shows Rapid Gain

THREE years' intensive sales effort to develop the industrial electric heating load on the system of the Edison Electric Illuminating



GROWTH OF INDUSTRIAL HEATING LOAD IN BOSTON

Company of Boston, Mass., shows a gain in connected load from 9,200 to 12,200 kw.; an increase in energy consumption of from 6,800,000 to 14,400,000 kw.-hr. and an increase in revenue from $113,000 to $223,000 annual yield. It is noteworthy that in 1924 the income from this class of service began to increase with great rapidity owing to the increased use of electricity in existing installations and to the use by some customers of 24-hour power in heating work. In 1925 the company's additional heating service brought in about $46 revenue per kilowatt of demand. J. L. Faden is electric heating engineer and L. R. Wallis superintendent of the sales department.

Digest of Electrical Literature

Hydro-Electric Development and Steam Equipment

Combustion in Latin Europe.—As a result of the recent tour of the principal power stations in the United States by a representative group of French engineers and their observations of modern American methods, it is expected that new extensions to existing plants in Europe will incorporate the latest improvements. Plans have already been passed for several installations employing among other features the use of water-cooled furnace walls. Although there is as yet no installation in service of this type, there appears to be no hesitation about its adoption for future plants. In connection with the increasing use of air heaters in modern installations, it is of interest to note that a French engineer, in collaboration with an expert on graphics, has succeeded in evolving a series of charts by the use of which a great deal of calculation for air heaters is eliminated. The use of pulverized coal is rapidly becoming universal as is evidenced by the number of contracts which have been made recently in numerous European countries. A royal decree in Spain provides for the establishment of a Spanish National Fuel Council, which will introduce regulations tending to the development and economic utilization of coal and lignite, the granting of financial facilities and the exemption of this industry from certain taxes. The development of hydro-electric power in Italy is making great strides. With the opening of the section of the railroad between Spezia and Sestri Levante, the whole of the railroad between Modena and Spezia, a distance of 225 miles, is now electrified, and it is intended to continue the electrification of the line as far as Liverno. Italy will then possess the longest stretch of electrified railroad track in the world.—*Combustion*, June, 1926.

Water Power and Steam Power in California Utilities.—H. A. BARRE.—There has always been more attendant publicity in connection with the development of water power than there has been with the development of steam power. This widespread publicity, coupled with the existence of low rates and the almost universal use of electric service in California, has apparently given rise to the impression that water power has been the cause of these desirable results. The high economies that have been obtained in the recently completed steam plants of the Los Angeles Gas & Electric Company at Seal Beach and the Southern California Edison Company at Long Beach have made a decided difference in the situation. While the older steam plants in California have economies of 200 kw.-hr. to 260 kw.-hr. per barrel of oil under full-load conditions, the economy of these new plants is of the magnitude of 425 kw.-hr. to 450 kw.-hr. per barrel. At such efficiencies the fuel cost with oil at $1 per barrel ranges around 2¼ mills per kilowatt-hour, a figure so low that additional stream-flow plants in California are practically out of the question and plants having storage facilities must be scrutinized more carefully than heretofore. Only an increase of several hundred per cent in the price of fuel can change this condition.—*Journal of Mechanical Engineering*, June, 1926.

Generation, Control, Switching and Protection

Exciter for Wide Regulating Range.—F. LEYERER.—Large synchronous generators require very considerable voltages and currents for their excitation, for which reason the use of series-resistance regulators becomes uneconomical. In many such installations the main exciter is energized by an auxiliary exciting unit. This eliminates the waste but necessitates two units. On the other hand, some installations, particularly synchronous condensers, demand a regulation within a very wide range, in which case the customary exciter becomes unstable. According to a recent invention of Mr. Osanna, both of these problems can be solved satisfactorily by using a split-pole generator. A bipolar machine of this type carries four poles and represents really the mechanical and electrical combination of two two-polar machines, with an auxiliary set of brushes half way between the main brushes. The two main fields can be made either to boost or to buck each other, and as they are unequal, a regulation of, for example, plus 220 volts to minus 30 volts can thus be obtained, throughout which wide range the generator remains fully stable. The characteristics of such split-pole generators are explained, and a number of photographs are reproduced to show recent installations. The author indicates the possibility of quickly de-energizing very large generators by using an Osanna exciter in conjunction with an oscillatory resistance.—*Siemens Zeitschrift*, April, 1926.

Transmission, Substations and Distribution

7,500-Kva. Synchronous Condenser.—J. RICALENS.—It was desired to connect to the end of a 45-mile transmission line a synchronous condenser capable of an output of 7,500 kva. when overexcited and an absorption of 4,000 kva. when underexcited, with 10 per cent voltage variation. The machine was built for 750 r.p.m. with salient poles sufficiently strong to withstand a 25 per cent overspeed. The winding of the stator is insulated for 3,000-volt operating potential. The required wide range of excitation, varying from a few amperes up to 600 amp., called for a potentiometer method of regulation with two cascaded exciters. A perfect sinusoidal voltage curve was obtained, owing largely to the use of specially built-up and multiple-transposed stator conductors in the slots. The machine is started with a synchronized induction motor. During its test run the total losses were measured as 219,680 watts, or 2.92 per cent of the output of the machine.—*Bulletin de la Société Alsacienne de Construction Mécaniques*, April, 1926.

Reliability of Large Mercury-Arc Rectifiers.—R. SCHUHMACHER.—It seems that the opinions about the reliability of large rectifiers do not fully agree as yet. This may be attributed to the relative newness of this type of apparatus and to the fact that experiences from one plant may be generalized as applying to another plant with totally different operating conditions. Gathering practical experiences from a wide variety of installations, the author gives a large amount of valuable information on the various parts of modern rectifiers. Tanks and their welding, vacuum-tight joints, air pumps, transformers and auxiliaries are exhaustively investigated. One of the greatest dangers of rectifiers was back-firing, which invariably resulted in a dead short circuit. After describing quick-opening circuit breakers, the writer shows by oscillograms how such breakers effectively prevent trouble of this nature. He maintains that rectifiers are in nine out of ten cases mysterious additions to put under the care of an operator. Not being familiar with their design and operation, most attendants will neglect a rectifier at the first sign of trouble. It is therefore suggested that the operator be thoroughly trained, preferably at the factory where the apparatus is made, before he is trusted with its supervision. Because it is totally different in operation and characteristics from a rotating machine, the average power-house man cannot otherwise be expected to keep a rectifier in as good working order as desirable, although the apparatus itself is today fully as reliable as any other type of machinery.—*Elektrotechnische Zeitschrift*, March 25 and April 1, 1926.

Breaking of Overhead Transmission-Line Cables.—W. GAUSTER.—Experimental tests were made on a number of towers of a 110-kv. transmission line to determine the mechanical phenomena occurring when one of the electric conductors is ruptured. To record these transients of short duration, the author developed a mechanical torsigraph for the motions of towers and a photographic registering instrument for motions of the cable. The results obtained approximated closely those derived from mathematical computations. When a cable breaks the adjacent towers are subjected to a pronounced torsional stress, which may be 10 to 40 per cent greater than the normal static stress. The additional strain from the rebounding cable trunk may be neglected.—*Elektrotechnik und Maschinenbau*, April 11, 1926.

Units, Measurements and Instruments

Notes on the Testing of Static Transformers.—J. LINDLEY THOMPSON.—The paper describes the usual methods adopted in the commercial testing of static transformers. Emphasis is laid on the need for accuracy, and methods are suggested whereby it can be obtained. The drying out of transform-

ers, the determination of dryness and the measurement of insulation resistance are discussed. The measurement of the iron loss and load loss is described, together with a method for obtaining greater accuracy. The measurement of form factor and its effect on the loss measurements are dealt with, and methods for determining the ohmic resistance, also corrections for the same, are detailed. The loading of transformers for a full-load test and the temperature-rise readings obtained on this test are discussed. Overpotential and pressure testing are described, and the methods of measuring high voltages are detailed.—*Journal of Institution of Electrical Engineers* (*England*), May, 1926.

Current Transformers with Nickel-Iron Cores.—THOMAS SPOONER. — The accurate metering of power supplied at high voltages is difficult owing to limitations in the performance of through-type current transformers. With a single turn for the primary the available mmf. for low currents is very small. For a standard 5-amp. secondary winding the number of secondary turns is fixed by the ratio; therefore for a given burden inductions in the cores are high, which means relatively large core losses and magnetizing currents. As the transformer ratio decreases the phase-angle errors rise very rapidly because of losses and the low permeability at low inductions for the ordinary silicon-steel core materials. There has been developed recently a nickel-iron alloy called "hypernik" which has especially low hysteresis loss and high permeability at low inductions. Owing to these properties the material is particularly suitable for the cores of current transformers. A ring-type series transformer with a core of hypernik has approximately one-third of the ratio and phase-angle errors exhibited by a similar transformer having a core of ordinary silicon steel. The article shows the relative performance of transformers with cores of the two kinds of material. It has been determined that the minimum ratio for which satisfactory performance can be obtained with a through-type transformer having a hypernik core is about 200 to 5. The application of this material for improving current-transformer practice is exceedingly simple since it involves no changes in the general transformer design and no changes in the existing meters. — *Journal of A.I.E.E.*, June, 1926.

Traction

Remote-Control Contactors.—R. ALLIAUME.—The Parisian street-railway system has had in successful operation for the last two years a variety of specially developed remote-control contactors, which serve the sectionalizing and emergency switching of many of its trolley feeders. Some of these contactors are operated by solenoid-actuated levers, while others use a magnetically tilted mercury contact. Connections can be made with this apparatus so as to utilize the smallest number of pilot wires for a maximum of operations. It was found that, in general, n pilot wires may serve $2(n - 1)$ different operations. The contactors may derive their energy either from a small 110-volt battery or directly from the 600-volt trolley feeders. *Revue Générale de l'Electricité*, April 17, 1926.

Telegraphy, Telephony, Radio and Signals

Power Distriction and Telephone Circuits. — H. M. TRUEBLOOD and D. I. CONE.—Consideration of the relations between power distribution and telephone systems is involved in any thorough review of the problems of the expanding power-distribution networks in this country. Recently the joint general committee of the National Electric Light Association and the Bell Telephone System has undertaken comprehensive investigations of these problems. Of particular interest is the study now progressing actively at Minneapolis of induction under conditions of joint use. Situations of exposure fall into three groups, determined by the character of the area served—(1) "downtown" districts, (2) residential urban districts, (3) rural districts. The major problems arise in the second group. Among technical features, coefficients of induction for close exposures, shielding action of metallic cable sheaths for both power and telephone circuits and "ground potential" effects are distinctive problems. Where both classes of circuits are in cable with suitable precautions as to grounding, interference is rarely to be anticipated. Various methods for reduction of disturbing effects are discussed in this paper. The closely related matter of unbalances in the telephone plant is briefly discussed. Single, two-phase and three-phase arrangements are compared from the induction standpoint.—*Bulletin of Bell Telephone Laboratories, Reprint B*-191, April, 1926.

Motors and Control

Electric Rock Drills.—K. SALEM.—Soft minerals or minerals having a medium hardness, such as potassium salts and the softer kinds of coal, are generally mined by blasting with explosives. The latter are inserted and ignited in blow holes previously drilled in the rock. Blow holes are no longer made by hand, special rotating or reciprocating drills being used for boring them. The former machines are usually electric and are displacing the reciprocating drills on account of their high efficiency and economy. Two types of rotating drilling machines have been developed, a light hand drilling machine and a larger drilling machine for mounting on a special standard. Both types are constructed for three-phase current and voltages up to 220. The hand-drilling machine is mainly suitable for boring in soft coal, lime and gypsum and must be supported by the operator during the drilling process. It is capable of boring in soft coal with a speed up to 48 in. per minute. The larger drilling machine is used when the capacity of the hand machine is too small. For heavy duty the latter is liable to get hot owing to an excessive pressure being applied on the drill. On the larger type the drilling pressure is taken by a fixed standard and the longitudinal motion of the drill is automatic. Further, the forward speed of the drill automatically diminishes when the boring resistance exceeds a certain limit—as, for instance, when the hardness of the mineral increases—so that the motor cannot be overloaded. The machine is designed for a normal drilling pressure of 940 lb. The longitudinal speed of the drill can be greatly increased for its withdrawal or insertion into an existing hole, while at the same time its rotary motion is stopped. The advantages of this feature are increased rapidity of operation and the absence of danger that the operator may be caught and wounded by the rotating spindle. The boring capacity of the drilling machine can be augmented by using special drill bits. These are fitted to the end of the drill and have a particular shape, with cutting bits arranged eccentrically, thus giving the drill a breaking action. The bored material is not finely pulverized but ground into small grain-shaped particles and a smooth cylindrical hole is obtained. — *A.E.G. Progress*, May, 1926.

Heat Applications and Material Handling

Electric Arc Welding in the Steel Industry.—Electric arc welding, according to a statement by the Mid-American Welding Engineering Company, provides a satisfactory means of welding without preheating or the removal, otherwise necessary in many cases, of parts made of gray iron. Work which has been done in this direction includes blowing-engine cylinders, large gas-engine cylinders which operate on blast furnace or producer gas, crane-engine cylinders, locomotive-engine cylinders, pump cylinders, steam separators and steam traps. The saving in work of this type is usually very large. The electric welding of flues to the back flue sheet of boilers is an important application of electric arc welding and cannot be done in any other way. Welding fire cracks in the fire box of boilers for locomotives is another application of electric arc welding. In dinky locomotives the same job frequently occurs, fire cracks often having to be welded on short notice. Welding in place of calking with the electric arc is an important application in steel-plant work. Jobs of this nature are found on gas lines carrying producer gas or blast-furnace gas, on the blast-furnace shell itself and on stoves. Electric arc welding finds a wide field of usefulness in the repair of broken and worn steel castings. Under this classification come yokes, truck frames and trunnions, hot-metal ladles, steel castings on gas producers and stoves, electric cranes, trucks and manipulator castings. Electrically welded stacks for the open-hearth sheet mill and miscellaneous smokestacks about the mill are better and last longer than ordinary riveted stacks. Miscellaneous manufacturing operations using electric welding are of great advantage many times. Gear cases, tanks, galvanizing kettles, alloy pots, water-cooled pipes, shop trucks, storage bins, etc., are operations under this classification. The article proceeds in great detail to list the possible and probable applications of electric arc welding.—*Iron and Steel Engineer*, June, 1926.

News of the Industry

"Perfecting" Shoals Bill

Amendments Asked by Opponents Would Place It Outside Category of Practical Legislation

By PAUL WOOTON
Washington Correspondent
ELECTRICAL WORLD

"PERFECTING" amendments to the Muscle Shoals bill, of which Senator Heflin of Alabama, who prefers the Air Nitrates and American Cyanamid Company's bid, has been talking, finally were introduced this week. Were Congress to adopt the amendments, it is certain that no bidder could comply with some of the conditions at least.

One amendment requires, after six years, the annual production of 40,000 tons of nitrogen under any and all conditions, whether or not there is a market for it. Since it requires a turnover of some $20,000,000 to produce that quantity of nitrogen, it would take only a few years of no demand to break even Henry Ford. The Heflin amendment follows the language of the Ford offer but goes further. Were the United States Steel Corporation required to operate at full capacity, regardless of market conditions, a parallel would be presented, say friends of the bill

There also would be objection to the provision giving the Secretary of War absolute authority to cancel the leases. Another amendment requiring that the surplus power be used first to meet local demands defeats the distribution idea on which other Southern states are relying. Senator Heflin also promises to introduce an amendment proposing that the government construct Dam No. 3. This will meet with no objection from those immediately interested in the maximum development of the river, but the administration already has turned down its thumbs on further expenditures on the Tennessee. He would, besides, insist on a further amendment reducing the price to be paid the government for hydro-electric power.

Conowingo Generators Are Now Being Built

Four of the seven 50,000-hp. waterwheel-driven generators which are to constitute the initial installation at the Conowingo plant of the Susquehanna Power Company are now being built by the General Electric Company. They are rated at 40,000 kva., 90 per cent power factor, and 13,800 volts, with a speed of 81.8 r.p.m. An order for the other three machines has been placed with the Westinghouse Electric & Manufacturing Company. Four of the waterwheels will be built by the Allis-Chalmers Manufacturing Company and three by the I. P. Morris Company. Ultimately the plant is to contain eleven generators and will be able to produce 1,360,000,000 kw.-hr. in an average year, with a net head of 89 ft. The machines are to be installed in a power house 175 ft. wide with an initial length of 620 ft. and an ultimate length of 900 ft. From the bottom of the draft tubes to the top of the high-tension switching station on the roof will be 230 ft. The bottom of the draft tubes will be 25 ft. below sea level. Transmission to Philadelphia will be at 220 kv.

To Join in Basle Meeting

Americans to Contribute to Swiss Sectional Gathering of World Power Conference Next Year

AT A MEETING of the American executive committee of the World Power Conference held in New York on May 26 it was voted to participate in the sectional meeting of that body to be held in Basle, Switzerland, Aug. 31 to Sept. 12, 1926. This meeting has been organized by the Swiss national committee primarily as a European sectional meeting. All other countries have, however, been invited to present papers on the topics to be discussed and to send delegates to the conference.

The program is to be more limited than the program of the first general conference held in London in 1924, five topics only being considered. The American executive committee has made arrangements for preparation of a paper under each one of the specified topics of the conference as follows:

"Utilization of Water Power and Inland Navigation," by Col. Hugh L. Cooper, consulting engineer, New York City.

"Exchange of Electrical Energy Between Countries," by Col. William Kelly, director of engineering N.E.L.A. (formerly chief engineer Federal Power Commission).

"The Economic Relation Between Electrical Energy Produced Hydraulically and Electrical Energy Produced Thermally: Conditions Under Which the Two Systems Can Work Together with Advantage," by W. E. Mitchell, vice-president Alabama Power Company, Birmingham.

"Electricity in Agriculture," by Dr. E. A. White, director National Committee on the Relation of Electricity to Agriculture, Chicago.

"Railway Electrification," by W. S. Murray, consulting engineer, New York City.

In addition to these five papers a general paper is being prepared by Messrs. Grover and Hoyt of the United States Geological Survey on "National Aspects of the Study of Water Resources."

There will be no attempt on the part of the American committee to organize a delegation to send to Basle. Several members of the committee, however, expect to be in Europe during the period of the conference and will be designated as delegates of the American committee, and the committee would be glad to get the names of others who will be able to attend. O. C. Merrill, general chairman of the American committee, will attend as representative of the committee, will act as the committee's member on the international executive council, and has been designated by the President as delegate on behalf of the United States to the conference, such action having been taken at the request of the Swiss government.

Brown Boveri to Build Great Turbine

United Electric Light & Power Company of New York Orders 160,000-Kw. Compound Unit for Erection in Its Hell Gate Power House

ANNOUNCEMENT is made by the United Electric Light & Power Company as the ELECTRICAL WORLD goes to press of the purchase of a unit of unprecedented size for its Hell Gate station in Bronx Borough, New York City. The order has been placed with the recently formed American Brown Boveri Electric Corporation, and its installation will be made under the supervision of Thomas E. Murray, Inc., as consulting engineers. The unit has a continuous-load capacity rating of 160,000 kw. at 85 per cent power factor, or 188,250 kva., and will generate current at 13,800 volts, 60 cycles.

This is the eighth unit to be installed in the Hell Gate station, which is operated as part of the Edison-United system, and will increase the continuous operating capacity of the station to 445,000 kw. It will be a compound unit consisting of a single-flow, high-pressure element operating at 1,800 r.p.m. and a double-flow, low-pressure element at 1,200 r.p.m. There will be an exciter directly connected to each generator. The generators will require 264,500 cu.ft. of cooling air furnished by external blowers.

The steam turbine will be of reaction type throughout. It is designed to occupy the same space allotted to each of the other units, and its installation will complete the equipment of the present station building. It is to operate under the present steam conditions of the station, 265 lb. pressure at the turbine throttle, with 200 deg. superheat, and is designed for bleeding for feed-water heating. The high-pressure turbine portion is designed to be capable also of utilizing steam at a maximum temperature of 750 deg. F. The unit will weigh approximately 2,800,000 lb., the heaviest piece for erection weighing 330,000 lb.

The unit is purchased for operation early in the summer of 1928. It will be assembled and shipped from Camden, N. J., where the American Brown Boveri Corporation has its main construction plant.

California Still Leads Nation in Rural Service

Work of the California Committee on the Relation of Electricity to Agriculture will be carried on for another year as the result of a decision reached at a recent meeting of leaders in agriculture and the electrical industry at which the activities of the committee since its inception in 1924 were reviewed and its plans for the future were outlined. The meeting was held at Santa Ana and was attended by one hundred of the principal men of the two industries interested. J. J. Deuel, manager of the law and utilities department of the California Farm Bureau Federation, presided.

With fourteen important studies either completed or under way, the committee has already justified its organization, a cording to Prof. L. J. Fletcher, chairman of the committee. He indicated what might be expected in the way of results from the survey which is being made of the 47,000 agricultural consumers on the lines of California power companies when he stated that a check of 9,000 of the questionnaires which have been returned showed 7,936 irrigation motors on these farms with a total installed capacity of 143,551 hp. He stated further that one-half of all power used on the farms of the state is electrical.

R. H. Ballard, vice-president Southern California Edison Company, declared that the movement was full of promise both for the electrical industry and the farmers. He pointed out to the farmers that the extension of municipal or state ownership of public utilities will increase the tax burden now borne by agriculture. A. Emory Wishon, vice-president San Joaquin Light & Power Corporation, appealed to the farmers to consider agriculture as a business and urged them to bring their business problems to the attention of business men for assistance in their solution.

S. S. Knight, representative of the Farmers' Union, pointed out that 30 per cent of the primary power on the farms of the country can be replaced with electric motors. The national average at the present time is 5 per cent and in California the average is 25 per cent. He said that 65 per cent of the farms in California have electric service. Roy Bishop, president Orange County Farm Bureau, also indorsed the work of the committee.

Ohio Public Service Studies New Plant Possibilities

Preliminary surveys are being made by the Ohio Public Service Company with a view to constructing a new generating station to be located advantageously with respect to the territory served by the company. Definite plans as to the probable size of the plant have not been made and the exact location has as yet to be determined. Several sites on the Ohio River where coal and water conditions are favorable are under consideration at the present time, but it is not considered likely that actual construction will be commenced for the next eighteen months.

The territory served by the Ohio Public Service Company includes the cities of Lorain, Mansfield, Sandusky, Elyria, Warren, Alliance, Massillon, Port Clinton and Ashland in northern Ohio. Generating stations totaling 135,000 kw. capacity are operated at Mansfield, Lorain, Warren and Massillon. The company's system is part of the interconnected power system in Ohio totaling upward of a million and a quarter horsepower in generating capacity. Under interconnection contracts energy is exchanged between the Ohio Public Service Company, Ohio Power Company, Cleveland Electric Illuminating Company, Northern Ohio Power & Light Company, Pennsylvania-Ohio Power & Light Company and the Toledo Edison Company. Plans for this additional capacity for the Ohio Public Service Company have been deemed necessary to handle the increasing industrial load and to provide further assurance of continuity of service.

Intercompany Contracts to Be Regulated in Massachusetts

An important act passed by the Massachusetts Legislature at the session recently closed provides that no electric utility company shall hereafter enter into a contract for the purchase of electricity covering a period of more than three years without the approval of the Department of Public Utilities unless such contract contains a provision subjecting the price to be paid for electricity thereunder to the review of the department in any proceeding brought under the rate-regulating provisions of the state. Industrial contracts are not included in this act, which is designed to increase the regulative powers of the state in connection with the sale of energy between electric light, power and transmission companies, whether independent or operated by holding companies.

Ownership of Shoals Distributing Company

Alabama Power and Georgia Railway & Power Subscribed for 31,250 Shares Each, Tennessee Electric and Mississippi Power for 12,500—Other Holders

COMPLYING with the McKellar resolution adopted recently by the Senate asking for information on the stock ownership of the two companies fathered by the Southeastern systems whose bid for the government's power plants now awaits action, the following information has been furnished the joint committee on Muscle Shoals by the Muscle Shoals Power Distributing Company:

1. The Muscle Shoals Fertilizer Company and the Muscle Shoals Power Distributing Company are corporations organized and existing under the laws of the State of Florida.

2. The authorized capital stock of the Muscle Shoals Fertilizer Company consists of 100,000 shares, each share of the par value of $100. All of this stock has been subscribed for by the Muscle Shoals Power Distributing Company.

3. The authorized capital stock of the Muscle Shoals Power Distributing Company consists of 200,000 shares of common stock without nominal or par value.

4. The stock of the Muscle Shoals Power Distributing Company has been subscribed for by the several companies set out on page 191 of the committee's report and other companies as follows:

Name of Subscriber	Number of Shares Subscribed for at $80 each	Amount
Tennessee Elec. Pwr. Co.	12,500	$1,000,000
Memphis Pwr. & Lt. Co..	9,375	750,000
Jackson Ry. & Lt. Co...	6,250	500,000
Mississippi Pwr. Co....	12,500	1,000,000
Mississippi Pwr. & Lt. Co.	6,250	500,000
Mississippi Delta Pwr. & Lt. Co.	3,125	250,000
Alabama Pwr. Co.....	31,250	2,500,000
Gulf Power Co.....	6,250	500,000
Kentucky Utilities Co...	3,125	250,000
Gulf Electric Co.....	6,250	500,000
Georgia Ry. & Pwr. Co.	31,250	2,500,000
Louisiana Pwr. & Lt. Co.	6,250	500,000
Arkansas Lt. & Pwr. Co.	9,375	750,000
New Orleans Pub. Serv., Inc.	9,375	750,000
Central Georgia Pwr. Co.	6,250	500,000
Total subscriptions...	159,375	$12,750,000

In transmitting the information Thomas W. Martin, the president of the Distributing company, wrote Senator Deneen as follows:

"In this connection permit us to say that, in addition to the money obtained from stock subscriptions, the Muscle Shoals Power Distributing Company will be able to obtain funds by the sale of power, by the issuance of preferred stocks and by the issuance of bonds, notes and other forms of indebtedness. The stock subscriptions are accordingly designed to provide the initial amount of money we may wish to invest for the purposes of these companies.

"You will also appreciate that the distribution of the power will be determined not by the stock subscriptions but by the need of power in the various states, by seasonal variation in stream flow, by the economic factors entering into the transmission of power, by the investment necessary to transmit the power and by similar economic factors.

"We beg to assure you that in addition to these financial plans we have gone as far as is possible until the lease provided for in our proposal is made. We are ready to move forward promptly when this is done."

RELATION OF CHEMICAL BIDDERS

Letters sent by direction of the Senate to the American Cyanamid Company and the Union Carbide Company inquiring concerning "any agreement or contract" that may exist between them elicited the details of a tentative working plan which had already been put before the congressional committee. L. H. Davis, consulting engineer of the Union Carbide Company, wrote in response to the congressional inquiry:

"It was not possible to work out the details of a formal agreement in advance of exact knowledge of the nature and precise terms of the proposed lease to the American Cyanamid Company or its subsidiary, the Air Nitrates Corporation."

Purchases and Mergers

Predicted Transactions in Southeastern States Are Consummated—Many Other Sales

CHIEF among movements toward solidarity among electric light and power companies in the last ten days is the simultaneous purchase of stock in the North American Light & Power Company by the North American Company and the Middle West Utilities Company. This tripartite arrangement, which of course involves no element of merger or absorption but which may lead to notable interconnections of systems in the Central States, is reported under a separate heading on page 1414.

As foreshadowed in these columns last week, the Southeastern Power & Light Company has acquired the Georgia Light, Power & Railways Company, controlling the electric light and power, railway and gas utilities in Macon, and has also bought the Athens (Ga.) Railway & Electric Company. The Athens utility was controlled by the Doherty interests. In addition, announcement is made of the Southeastern's acquisition of the Georgia Southern Power Company of Dublin and the newly organized Georgia Utilities Company, which embraces properties in the northern part of the state. These new accretions to the Southeastern Power & Light's system will be supervised by the Georgia Railway & Power Company.

The deal reported last week involving the purchase of the common stock of the Georgia-Carolina Electric Company by the Georgia-Carolina Power Company, a subsidiary of the Augusta-Aiken Railway & Electric Company, was consummated at the stockholders' meeting on June 17, and the purchase by the Georgia-Carolina Power Company of the Carolina Light and Power Company of Aiken, S. C., was also confirmed. Several transmission lines and distributing systems in Georgia were also purchased, the largest of these being the transmission line of the Georgia Railway & Power Company from the Broad River to Augusta.

Five light and power properties operating in the northern Michigan and Wisconsin mining territory have been taken over by the Peninsular Power Company of Milwaukee, a North American Company property. These companies are the Powers-Spaulding Light & Power Company of Powers, Mich.; the Dickinson County Public Service Company, operating between Crystal Falls and Channing, Mich.; the Aurora Electric Light & Power Company, operating in the town of Aurora, Wis.; the Amasa Lighting Company, serving the town of Amasa, Mich., and adjacent territory, and the Alpha Lighting Company, Alpha, Mich. Most of these properties have been buying their energy from the Peninsular Power Company. The purchases are said to have involved more than $500,000.

Approval of a stock and bond issue totaling $1,200,000 by the Indiana-Ohio Public Service Company of Union City for the purchase of the Union Heat, Light & Power Company was granted June 18 by the Indiana Public Service Commission, following a recent opinion that purchase of a company which operates partly in Ohio comes under the regulatory laws of Indiana.

All properties of the Alton Gas & Electric Company and the Alton, Granite & St. Louis Traction Company were sold under foreclosure proceedings at the Madison County Court House in Edwardsville, Ill., on June 16. The properties were sold in five parcels and brought a total of $1,965,000. The only bidder at the sale was Louis H. Egan, president of the Union Electric Light & Power Company of St. Louis, a member of the bondholders' committee. Like the property sold at auction, the Union Electric Light & Power Company is controlled by the North American Company. It is understood that the bondholders plan to reorganize the properties into three companies and that each will be operated separately. The traction company has been in receivership since 1920 and the gas and electric company since last December.

Permission has been granted by the North Dakota Board of Railroad Commissioners to G. L. Paxman to sell his electric property at Hamilton, N. D., to the Otter Tail Power Company, Fergus Falls, Minn.

The Wisconsin Railroad Commission has granted a certificate of convenience and necessity to the Oneida Power Company to purchase two dams near the village of Biron, Wood County, owned by the Consolidated Power & Paper Company, Wisconsin Rapids, at a price of $2,000,000.

The New York Public Service Commission has authorized the transfer of the franchises and plants of the Brier Hill Electric Light & Power Company and the Rensselaer Falls Electric Light & Power Company, both doing business in St. Lawrence County, to the St. Lawrence County Utilities, Inc.

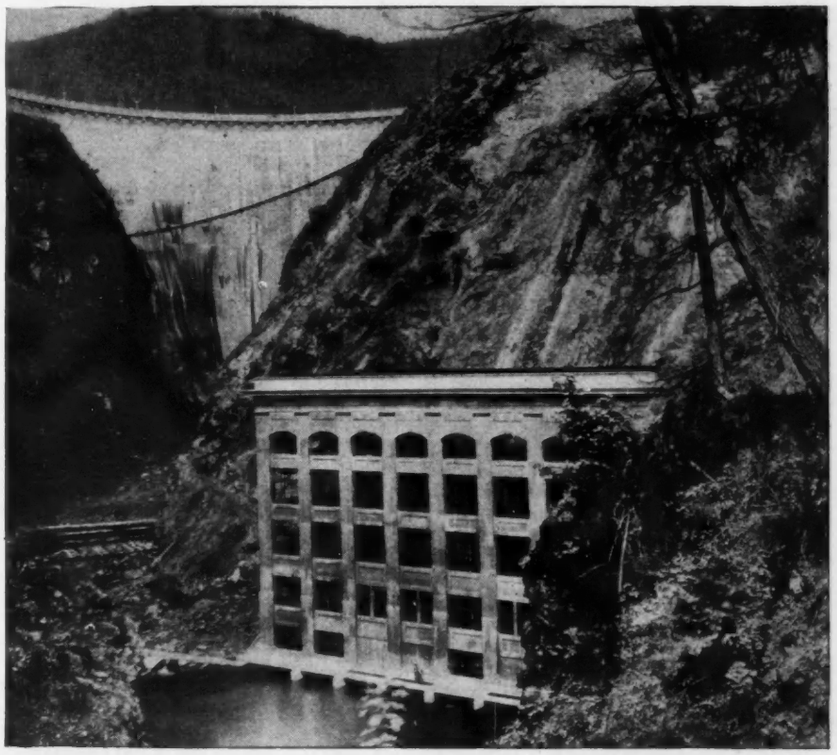
The New York Public Service Commission has granted permission to the Adams Basin Electric Light & Power Company to transfer its franchise and plant to the Rochester Gas & Electric Corporation. Service is furnished in Ogden, Parma and Sweden, Monroe County.

The Kentucky-Tennessee Light & Power Company has received permission from the Tennessee commission to purchase the municipal light plant at McKenzie, Tenn., for $79,000.

The New Jersey Public Utility Commission has authorized the merger of the Browns Mills Electric Light & Power Company and the New Egypt Light, Heat, Power & Water Company with the Eastern New Jersey Power Company of Asbury Park.

Purchase of the electric light and power plant of the Farmersville Mill &

Cushman Power House and Dam Now Serving Tacoma



BRINGING into service the Cushman hydro-electric development, 50 miles northwest of Tacoma, Wash., has given that city 50,000 additional horsepower, and much civic jubilation was aroused by the completion of the first step in this noteworthy municipal enterprise. Before its absorption Lake Cushman lay in the gorge of the North Fork of the Skokomish River in the foothills of the Olympic Mountains. By building a second dam below the present power house and installing there two 45,000-hp. units the city plans to possess eventually a plant rated at 140,000 hp. and delivering energy to it over the double-circuit 110-kv. transmission system. This line crosses the Narrows of Puget Sound on 315-ft. steel towers, to which the city points as the visible sign of the project on which it has already spent $5,250,000.

Light Company by the Texas & Louisiana Power & Light Company is announced. This plant was one of the first to be installed in Texas. The Texas & Louisiana Power & Light Company has acquired, it is reported, about 50 small electric plants.

The light and water plant of the city of Edinburg, Tex., was recently sold to the Valley Electric & Ice Company of San Benito, Tex., for $140,000. The Valley Electric Company — a Middle West Utilities property—owns and operates the light and power plants of all but two cities in the Rio Grande Valley of south Texas.

New Group in Central West

North American and Middle West Utilities Buy Into the Studebaker Holding Company

AN IMPORTANT announcement was made on Friday, June 18, when it was given out that the North American Company in conjunction with the Middle West Utilities Company was to take over a large block of the common stock of the North American Light & Power Company. This new line-up among prominent holding companies controlling light and power properties provoked much interest in central-station circles.

The North American Light & Power Company, serving 700 communities in Illinois, Iowa, Missouri and Kansas through subsidiaries, is the holding company which owns the common stock of the Illinois Power & Light Corporation, of which Senator William McKinley of Illinois has been chairman of the board; the Missouri Power & Light Company, the Des Moines Electric Light Company, the Kansas Public Service Company, the Topeka Edison Company and many other Middle Western properties. William A. Baehr is president and general manager of the North American Light & Power and Clement Studebaker, Jr., chairman of its board.

The motive that has brought these three great holding companies into alignment is understood to be that of interconnecting their transmission systems, which now adjoin one another in many districts, but are nowhere actually competitive. Such interconnection will be a long step forward in the creation of a unified Middle West system covering a greater territory than any one of three companies can reach alone, extensive as their several ramifications are.

New financing on an extensive scale will, it is intimated, take place, but no details of reorganization plans have been made public. It is announced, however, that Mr. Studebaker will retain his holdings and his office in his own company. Neither the operating staff of the North American Light & Power nor the staffs of the subsidiary operating companies will be affected by the reorganization. The Middle West Utilities Company and the North American Company, it is asserted further, though not officially confirmed, will each secure a one-third interest in the common stock of the reorganized North American Light & Power Company, the other third interest to be held by Mr. Studebaker and his associates. Senator McKinley, whose stock holdings are understood to have been small, is expected to retire from the public utility field.

A.S.T.M. Asks Industries to Aid Research

All the industries of the nation that benefit by the work of the American Society for Testing Materials are to be urged by that body, through its executive committee, to contribute toward a fund to help it carry on its researches. This action was indorsed at the annual convention of the society, held from Monday to Friday of this week at Atlantic City. W. H. Fulweiler of Philadelphia, the retiring president, urged the importance of scientists who devise new methods being certain that these methods can be depended upon to produce the same results at all times. New officers elected are: President, J. H. Gibboney, Roanoke, Va.; vice-presidents, G. W. Thompson, Brooklyn, N. Y., and Floyd M. Chapman, New York.

Federal Commission Grants a License for Lancha Plana

The Federal Power Commission on June 23 authorized a license for the East Bay Municipal Utility District of Oakland, Cal., covering a project on the Mokelumne River which is to consist principally of the Lancha Plana dam and reservoir, constructed primarily as a source of municipal water supply. Power is to be developed as a by-product. The conflicting application of Stephen E. Kieffer was rejected.

A preliminary permit was authorized for J. W. Preston, Jr., of San Francisco covering a power project on the Mokelumne and the North Fork of the Calaveras River and their tributaries in Calaveras County, Cal. The primary power available at that point is 11,300 hp.

A preliminary permit also was authorized for George B. McClary of Chicago covering two projects on Rock River in the vicinity of Grand Detour, Ill. He proposes to install 6,700 hp. at one development and 3,700 hp. at the other. To the Illinois Northern Utilities Company a preliminary permit was granted covering a project on Rock River near Byron, where it is proposed to install 12,700 hp.

A permit was granted to Ray K. Soland of Ann Arbor, Mich., covering a project on Fox River in Illinois. The power house is to be near Wedron, where 7,240 hp. will be installed.

Lancha Plana Development Authorized by California

The application made by the East Bay Utility District in California to divert 375 sec.-ft. of water from the Mokelumne River for power development at its Lancha Plana dam (see ELECTRICAL WORLD, May 22, page 1164) was granted by the State Division of Water Rights June 16. The filing was made in connection with a previous application of the district, granted April 17, to divert 310 sec.-ft. from the Mokelumne for municipal uses in the East Bay region. The district is authorized to store 217,000 acre-ft. per annum. The permit approved June 16 will allow, under a head of 325 ft., the development of 13,849 theoretical horsepower.

"The division views with some concern," says the opinion, given by Edward Hyatt, Jr., president of the commission, "the development of low-head, large-flow power projects on the lower reaches of large streams. If allowed to proceed unrestricted, such plants will establish rights to stream flow which grossly hamper the fullest economic development of the streams. Little, if any, feasible storage is available below such plants, and the result is that releases during the winter season escape to the sea unused. We feel it but reasonable, therefore, that future development on the Mokelumne River shall be protected by a clause in the permit which provides that no right to the use of water shall be acquired under this application which may in any way interfere with future appropriations for agricultural or municipal purposes."

Interprovincial Hydro Development in Canada

Premier Taschereau of Quebec has announced that the much-discussed question of power rights on the Ottawa River, which forms the boundary between the Provinces of Ontario and Quebec, will be studied during the summer months by C. A. Magrath, chairman of the Ontario Hydro-Electric Power Commission, and Arthur Amos, chief of the Hydraulic Service of Quebec. These two men will present a report to the governments of Ontario and Quebec which will deal chiefly with the respective rights of the two provinces in regard to Carillon, Des Chats and other falls on the Ottawa River. Not only will the interprovincial boundary be delimited, but occasion will be taken also to judge as to the rights of the federal government in disposing of some of the water powers. While the two provinces are interested in establishing their standing in regard to Carillon, they will probably unite to prevent the federal government from making any move which would alienate their hold on that power.

The Canadian Senate has passed the bill incorporating the Gatineau Transmission Company, the subsidiary of the International Paper Company, which proposes to transmit power from the Gatineau River development in Quebec to the Ontario Hydro-Electric Power Commission at Toronto. The Gatineau is a tributary of the Ottawa. Amendments agreed to exclude the lines from the city of Ottawa and the thickly populated townships and make the consent of the Quebec Utilities Board and the government of Ontario necessary to the transmission plans in either province. Under the terms of its contract, just signed, with the Hydro-Electric Power Commission the Gatineau Power Company will furnish 230,000 to 260,000 hp. for transmission 240 miles to Toronto.

Newspapers and Public Utility Companies

Business Manager of New York *Times* Dwells on Relation Between Them and Gives Practical Counsel Concerning the Use of This Form of Publicity

A VALUABLE address was made by Louis Wiley, business manager of the New York *Times*, on Tuesday, June 22, when he appeared before the Public Utilities Advertising Association. This body met in Philadelphia as a division of the Associated Advertising Clubs of the World, which had gathered in the Quaker City for its twenty-second annual convention. Mr. Wiley dwelt on the things which newspapers and utilities possess in common, on the cultivation of good will by the utility companies through the newspapers, on the essentiality of frankness, on the importance of keeping employees in touch with advertising policy and with what is advertised, on the preparation of copy and the employment of agencies, and on the advantages of what he termed "institutional" copy over "pious protestation." His speech was in part as follows:

"One of your great problems is the cultivation and maintenance of the community's good will toward your companies. In the solution of this problem newspaper advertising can play an important part. I do not appear before you to urge that you take more advertising space in newspapers or to tell you that advertising will magically buy you good will. If you do not advertise intelligently, the better class of newspapers would prefer that you do not take space at all. Poorly conceived advertising will fail to bring you results and will hurt the reputation of this powerful business influence among you. Until you are convinced of what advertising will do for you, until you are ready to understand that what you say in your copy must be only the truthful reflection of your company's character and that advertising cannot conceal or atone for mistaken policies of management, until you have a definite goal to be achieved by taking space, I would advise you not to advertise.

"But if the underlying conditions are favorable, and you wish to establish your place in your community on a stronger basis and to increase your business, then consider advertising. I do not need to argue with you that advertising influences the consumer. The enormous volume of trade in the United States today is proof of the stimulating force of advertising, which has increased consumption, raised the standards of living and added enormously to our wealth. Nor is it necessary to elaborate upon the fact that the newspaper is the medium which more than any other reaches the people in the homes which you serve.

Advertising and Employees

"One of the excellent results of advertising by companies having extensive public relations is the effect upon the employees themselves. The public utilities may learn something in this direction from the great department stores. In such stores the employees are required to know what the company has advertised in the daily papers, both merchandise and institutional copy. The managers find that the employees take the keenest interest in the public advertising of the store's policy and goods. There is something stimulating in knowing that the news of the firm has been spread abroad. The influence which such advertising has upon employees is quite different from that made by a mere printed house organ or inspirational statements circulated only among the workers. Public utility advertising in newspapers should be carefully prepared to have the right effect upon the employees as well as upon the public.

"A number of public utilities advertise with fair regularity in the newspapers. Frequently the copy they use is not prepared with enough discrimination. I am aware of the assertion often made that public utility companies feel they must go in all local mediums, if in any. For all self-respecting newspapers I resent the inference that the editorial or news policy might be influenced by the advertising. But the point I am most interested in making is that the public utility companies would find it to their profit to adapt their copy to different newspapers. This is more trouble, but it is good advertising, and good advertising is profitable.

"Almost every public utility has been faced at some time by an emergency affecting its service to the public. Upon such an occasion it is wise to take the public into your confidence by frank statements of facts. That the newspapers afford the most effective means of doing so is obvious.

Praise for Agency Service

"Some of the public utility companies have inquired about the preparation of advertising. As the business manager of a newspaper, I want to say as strongly as possible that they should establish relations with a good agency and use its trained services. Probably a public utility company will find it advisable to maintain an advertising department to co-operate with and supervise the agency, but by all means the agency's useful services should be available. It brings to its task the trained abilities of a great many specialists, the knowledge gained by wide experience. The power of modern advertising has been tremendously increased and its rise to its present importance hastened by the agencies.

"I look for the greatest advance in public utility advertising in the future in the institutional form of copy. This is not easy to prepare. It is not difficult to turn out well-rounded phrases which have a pleasant sound and give a few officials a sense of gratified self-esteem. Institutional copy is biographical; and just as the biographer does not sit down and dash off an appraisal of a great man in a few sonorous words, so, too, you cannot expect our advertising writer to sum up in a happy moment the character which the thousands of employees of a company have built up in years. See to it that your institutional advertising is scrupulously honest with the public; and if it is not backed up by performance it will be in vain. The most pious protestations in advertising in the world may be just as untruthful as the cheap copy which intelligent persons can tell at a glance is false. If the publishers of great and successful newspapers have learned anything, it is the value of public confidence in what they print. I cannot think of anything so vital to a public utility, whose prosperity must be bound up with the fortunes of the community it serves, as public confidence. Advertising alone will not beget this confidence, but truth in advertising will."

The other chief speaker on the utility division program was W. N. Teasdale, advertising manager of the London & North Eastern Railway, England, who compared British and American utility advertising. M. S. Sloan, president of the Brooklyn Edison Company, spoke at a general session on "Advertising—Its part in the Development of Public Utilities."

Los Angeles Convention Closes in Good Fettle

The closing sessions of the Los Angeles convention of the Pacific Coast Electrical Association, like the sessions already reported (June 12, page 1311), were marked by optimism on the part of the speakers and a response in kind by those addressed. Several noteworthy addresses were made on Thursday and Friday.

Lester S. Ready, chief engineer of the California Railroad Commission, in speaking before the Public Relations Section, said that the way to retain the principles of effective regulation was for the companies to promote the best possible relations between themselves and their customers. Miss Isabell Davie of the national women's committee declared that "the problem of interpreting the uses of electricity to the feminine public is one for the women of the utility companies themselves to solve."

In discussing "The Interdependence of Industry," W. H. Onken, Jr., editor ELECTRICAL WORLD, pleaded for still greater faith in the industry and its possibilities and a combined effort for further growth and service. A. Emory Wishon, vice-president and general manager San Joaquin Light & Power Corporation, traced the development and growth of the electrical industry under private operation and showed that nowhere is there a greater consumption of electricity per capita or a lower cost for the service rendered than in this country. R. H. Ballard, the chairman of the public policy meeting at which Messrs. Onken and Wishon spoke, said in bringing it to a close that no one listening to the speakers could help but be impressed with the fact that "the private utilities of the country, publicly owned and operating under sound regulation, are adequately doing a big job."

The banquet on Friday evening at the Biltmore Hotel was well attended and well enjoyed.

S.P.E.E. Is Stimulated

Iowa City Delegates Hear Encouraging Reports—Co-ordinating Colleges and Industrial Establishments

EIGHTY institutions, representing 38 states, besides Canada and Brazil, sent 312 delegates and attendants to the thirty-fourth annual convention of the Society for the Promotion of Engineering Education, which was held at the State University of Iowa, Iowa City, June 16 to 18. A cloud was cast over this assemblage by the sudden death of Dean William G. Raymond of the university on the second day. This led to the abandonment of social features and the annual banquet.

The meetings were fruitful and stimulating. The papers evoked spirited discussion, in most cases limited only by the time available. The joint meeting of deans and administrative officers and teachers of English recognized two objectives, training the engineer to speak and write clearly and forcefully and fostering regard for literature. The consensus of opinion was that, in addition to the formal courses, the full co-operation of all departments of technical schools is essential to successful mastery of English by the student.

Almost exclusively the set program of the convention was devoted to results and interpretation of the findings of the research work started some years ago. Dean Anson Marston of Iowa State College gave composite results of questionnaires sent to 1,500 members of the A.S.C.E., the A.S.M.E. and the A.I.E.E. From these it was apparent that there is a general appeal for broadening of college courses and a tendency to have the engineering course include business training. Fewer than half the replies indicated a preference for functional division in courses as opposed to technical division. Need for the guidance of high-school students who choose engineering as a career was emphasized, and it was pointed out that less than half the students entering upon technical courses have any conception of their chosen field.

Dean C. E. Seashore, State University of Iowa, thought that the preliminary placement examinations, which are yearly being improved, are the means by which the student may be warned against entering a course for which he is unfitted.

EXTENSION AND CO-OPERATIVE COURSES

Extension courses had been studied by comparison with work in residence, and the conclusion from this study was that, properly administered, such courses may be made to furnish a ready means of keeping the graduate abreast with his field, as well as to offer opportunity to men who cannot attend college. Co-operative courses, half of the time being spent in college and half in industry in short-period alternation, have, it was reported, proved valuable in giving the student a perspective of actual working conditions. They permit more efficient use of space and equipment in the college, and often the utilization of equipment for research which would have been far beyond the means of the institution.

Two dominant notes were sounded throughout the whole discussion whenever the requisites for teachers were mentioned. The first and more insistent was, "Can the teacher teach?" The other was, "Is the teacher qualified as a leader in research and industry?" All seemed to agree that the teacher was the most important factor in the effectiveness of any curriculum.

In the presentation of the study relating to curricula, the subject of foreign languages aroused especial interest. Dean Cooley of the University of Michigan championed the study of languages for the practical reason of possible invasion of foreign fields. The findings of fact showed that foreign languages are not made admission requirements to the same extent as formerly nor so much required as courses of study in engineering colleges. Some held that foreign languages had never been shown to have enough more value than various other so-called cultural subjects to warrant their inclusion to the exclusion of the other courses.

BOARD OF INVESTIGATION

Probably the most important single feature of the convention was the report of the board of co-ordination and investigation. Associate Director H. P. Hammond's summary of the fact-gathering stages set forth such a mass of careful, thorough, inclusive evidence as to be almost unique in the history of engineering education. Chairman C. F. Scott reported on some of the administrative phases of the work. Noteworthy in his statement were the encouragement and appreciation expressed by the various bodies concerned and their admonition to proceed to the application of the principles evolved.

Director W. E. Wickenden made an analysis and recommendation on the basis of the facts found in the investigation. His report throughout was constructive. The present order would not be destroyed or crippled by his proposals, but rather would be strengthened and amplified. According to the report, the four-year course, with simplification and unification of subject matter, may be confidently expected to give a good general training upon which to build an intense technical knowledge by graduate study, extension courses or post-scholastic education. The technical engineer of today, the director said, is called upon to be thoroughly trained in one field and intelligent in several allied fields. This demands broad general training followed by education along with practice. The report repeatedly stressed the fact that concerted action by the colleges is necessary to insure real progress. It is evident that the colleges alone cannot solve the problem of engineering education, but that the industries, the engineering societies and the colleges must work together to meet their mutual obligations and serve their mutual interests. In the early fall a group of deans and executive officers will meet to formulate a program making for further co-ordination in engineering education.

Officers for the coming year will be: President, O. M. Leland, dean of engineering, University of Minnesota; vice-presidents, H. W. Tyler, Massachusetts Institute of Technology, and W. S. Rodman, University of Virginia; secretary, F. L. Bishop, dean of engineering, University of Pittsburgh; treasurer, W. O. Wiley. The next convention of the society will be held at the University of Maine, Orono.

Briefer News

Pasadena Municipal Plant May Double Capacity.—The municipal light and power department of Pasadena, Cal., which has now a rating of 18,000 kw., will almost double its capacity by the addition of a 15,000-kw. steam generating unit if the city carries out the recommendation of Benjamin F. Delanty, the general manager. This unit would cost, with accessories, $750,000 and would be ordered early next year and installed nine or ten months later.

Vermont Electrical Association Officers.—The Vermont Electrical Association has just elected at its annual business meeting, held at Bennington, the following officers: President, F. L. Lovett, Montpelier; vice-presidents, M. G. Clark, Burlington, and W. H. Lawson, Rutland; secretary-treasurer, A. W. Peterson, St. Albans. After this meeting the association enjoyed the hospitality of the New England Power Association, visiting the Davis Bridge and adjacent hydro-electric developments on the Deerfield River.

New High-Tension Line for Mohawk Valley, N. Y.—The erection of a 110,000-volt steel-tower transmission line

Coming Meetings of Electrical and Allied Societies

[A complete directory of electrical associations, with their secretaries, is published in the first issue of each volume. For latest list see ELECTRICAL WORLD, Jan. 2, page 80.]

American Society of Mechanical Engineers—San Francisco, June 28-July 1. C. W. Rice, 29 West 39th St., New York.

East Central Division, N. E. L. A.—Cedar Point, Ohio, July 13-17. D. L. Gaskill, Greenville, Ohio.

Association of Electragists International—Hotel Breakers, Cedar Point, Ohio, Aug. 24-27. L. W. Davis, 15 West 37th St., New York.

Camp Co-operation VI (local leagues)—Association Island, Henderson Harbor, N. Y., Sept. 1-4. (Society for Electrical Development, New York, is sponsor.)

Illuminating Engineering Society—Essex and Sussex Hotel, Spring Lake, N. J., Sept. 7-10. L. H. Graves, 31 West 46th St., New York.

Wisconsin Utilities Association, Electric Section—Eau Claire, Wis., Sept. 3 and 4. J. N. Cadby, 445 Washington Bldg., Madison, Wis.

Rocky Mountain Division, N. E. L. A.—Glenwood Springs, Col., Sept. 13-16. O. A. Weller, Public Service Co., Denver.

International Association of Municipal Electricians — Battery Park Hotel, Asheville, N. C., Sept. 21-24. E. H. Benz, West New York, N. J.

New England Division, N. E. L. A.—Poland Spring House, Poland, Me., Sept. 21-23. Miss O. A. Bursiel, 149 Tremont St., Boston.

Association of Edison Illuminating Companies — Chateau Frontenac, Quebec, Sept. 27-Oct. 1. P. S. Millar, 80th St. and East End Ave., New York.

Empire State Gas and Electric Association—Lake Placid Club, N. Y., Sept. 30-Oct. 1. C. H. B. Chapin, Grand Central Terminal, New York.

between Utica and Inghams, N. Y., at a cost of $400,000, has been started by the Adirondack Power & Light Corporation. The announcement of the extension, which will be a major unit in the interconnection program of the Mohawk Valley, was made last week by Otto Snyder, general manager. The line will be 20 miles long and will join the Niagara, Lockport & Ontario system at Utica.

Vice-Presidents of Northwest Electric Light and Power Association.—Besides electing D. C. Green, vice-president Utah Power & Light Company, Salt Lake City, association president for the coming year, as recorded last week, the Northwest Electric Light and Power Association at its Spokane convention elected these vice-presidents: For Washington, Norwood W. Brockett of Seattle; for Oregon, George L. Myers of Portland; for Utah, P. M. Parry of Salt Lake City; for Idaho, R. B. King of Boise; for Montana, W. B. MacDonald of Kalispell.

Abitibi Paper-Making Hydro-Electric Plants Now Generate 115,000 Hp.—The Island Falls power plant of the Abitibi Power & Paper Company of northern Ontario is now producing its total output of 60,000 hp. Power from the last 15,000-hp. unit was turned on recently, and the entire output, with the exception of minor sales to nearby municipalities, is now being utilized in the company's new electric-steam boilers. Abitibi's power plants at Iroquois Falls and Twin Falls produce 55,000 hp., so that the company's production now totals 115,000 hp.

Grand Boulevard to Become St. Louis' Chief "White Way."—Members of the Grand Boulevard Improvement Association have perfected plans for the installation of new ornamental lighting standards along that St. Louis thoroughfare between Laclede Avenue and Easton Avenue, which will be thirty times as powerful as the street lamps now in use. The new lights will, it is said, be installed as quickly as legal technicalities will permit the Board of Public Service to let contracts. Plans and specifications for them have been drawn in the laboratories of the General Electric Company. The standards proposed are 19 ft. in height to the center of illumination and hold two lamps of 1,500 cp. each. The metal posts are of special design, and alabaster rippled globes and canopies have been designed by the General Electric Company. The lamps will be spaced 100 ft. apart on both sides of the boulevard for about one mile, there being 56 standards on each side of the street.

New Officers for Industrial Engineers.—Following its Philadelphia convention last week, the Society of Industrial Engineers, through its board of directors, elected these officers: President, Dr. W. F. Rittman, Pittsburgh; vice-president in charge of education, Charles B. Gordy, Ann Arbor, Mich.; vice-president in charge of research, P. A. Fellows, Detroit; vice-president in charge of promotion, W. W. Nichol, Detroit; vice-president in charge of finance, S. F. Mitzner, Chicago, and executive secretary (re-elected), George C. Dent, Chicago.

Bunker Hill After 151 Years.—The Bunker Hill monument in the Charlestown section of Boston has been floodlighted and is now a landmark by night as well as by day. The sides are illuminated by six 18-in. General Electric incandescent searchlamps with 40-deg. spread prismatic lenses. The lamps

are 110-volt, 1,000-watt bulb projector lamps with monoplane filaments. The total beam candlepower is approximately 15,000,000. The lamps are on two 30-ft. iron poles placed diagonally across from each other so that two sides of the monument are lighted by each set of three searchlamps. The lamps are mounted on special bases, one fitting into the top of the pole and the other two into the ends of the cross-arm. One pole is 250 ft. from the monument and the other is 190 ft. away. The 221-ft. monument, which was lighted for the first time on the evening of Bunker Hill Day, June 17, is visible for a distance of 12 miles.

Electricity in Apple Orchards of Washington State.—Electrical experiments are being conducted in the hope of exterminating the codling moth in the apple orchards of Washington State. Under the direction of B. N. Burgland of Seattle, wires are strung through the trees, over which a powerful electric current will be passed. The plan has been used successfully on a small scale in rose gardens and cherry orchards in Seattle. The current is turned on but once a day for a period of about five minutes. An association of 25 growers has contributed $100 each to carry on the experiments.

British Financiers Will Light Jerusalem with Electricity.—A group of English financiers have taken over a pre-war concession for the electric lighting of Jerusalem which was granted by the Turks to Greek interests and is said to be valid for 60 years. The concession includes the city of Bethlehem and the whole country coming within the Rutenberg electrification scheme.

Parker Public Service Association Meets.—Managers of electric utilities affiliated with C. D. Parker & Company, Inc., Boston, held a meeting and outing on June 21 as guests of the Worcester Suburban Electric Company at Uxbridge and Whitinsville, Mass. About 75 attended and heard encouraging reports on new construction, load building and other business themes. Vice-president Bowen Tufts of the Parker company, Miss O. A. Bursiel, secretary New England Division, N.E.L.A.; Miss A. M. Baker of Hartford, chairman of the women's committee, and H. S. Knowlton, New England editor ELECTRICAL WORLD, made brief addresses. R. H. Alton was in charge of the program.

Transmission-Line Extension in Southwest.—Recent transmission-line construction reported by the Central & South West Utilities Company, an Insull organization, from the districts served by its operating companies in Texas, Oklahoma, Arkansas and Louisiana, includes a 67-mile, 66,000-volt line from Shreveport, La., to Texarkana, both of which towns are served by the Southwestern Gas & Electric Company; a 50-mile line from Gilmer to Mount Pleasant, Tex., and one of 26 miles from Big Sandy to Mineola, Tex., by the East Texas Public Service Company. Extensive new line construction by the West Texas Utilities Company has enabled that company to serve a number of additional towns and to extend the use of electric power on the larger ranches. The Southwestern Gas & Electric Company, as previously reported, has under construction a 40,000-kw. generating station at Shreveport.

Appalachian System Completes Another Transmission Link.—Completion of another important link in the extensive interconnected power system of the Appalachian Power Company, the recently organized Virginia corporation supplying electric power to western Virginia, southern West Virginia and eastern Kentucky, has been announced by General Manager J. W. Hancock. This link in the transmission system extends about 55 miles from Roanoke, Va., to Glenlyn on New River, where the company has a 75,000-hp. steam generating plant formerly owned by the old Appalachian Power Company. Two representatives of the company held an informal conference with members of the Danville City Council recently in connection with the possible purchase of the city's electric plant and gas works. The belief prevails that the Council, while vested with the power to sell the city plants, will order a referendum on the subject, with a recommendation either to sell or not to sell.

Men of the Industry

E. A. Feldtkeller Receives New Appointment

E. A. Feldtkeller, formerly general manager of the Alexandria (Va.) Light & Power Company, now the Alexandria division of the Virginia Public Service Company, has been assigned to the Florida-Georgia territory of the General Engineering & Management Corporation with temporary headquarters in St. Petersburg. His career in the public utility field started with a connection with the Milwaukee Electric Railway & Light Company, a property of the North American Company. Simultaneously with this work, which consisted in conducting surveys of the distribution system, he continued his education at the University of Wisconsin.

In 1910 he became superintendent of light and power and general superintendent of the Commonwealth Power Company and the Continental Realty Company, both of which at that time served the downtown section of Milwaukee. Later, after the North American Company had acquired the Globe Electric Company and the Western Engine & Dynamo Company of Chicago, he was appointed superintendent of these plants, which were engaged in war industries. Following the armistice Mr. Feldtkeller returned to the public utility field in the capacity of general manager of the Alexandria County Lighting Company and the Arlington Electric Company. When these properties were merged in 1922 to form the Alexandria Light & Power Company he assumed the duties of directing the consolidated company and has continued in that rôle until the present time.

Major-General James G. Harbord, president of the Radio Corporation of America, received the honorary degree of doctor of laws from Colgate University, Hamilton, N. Y., at the commencement exercises held June 14.

Gordon Kribs, chief electrical engineer with the New Brunswick Power Commission, has resigned. Mr. Kribs was formerly assistant electrical engineer with the Ontario Hydro-Electric Power Commission.

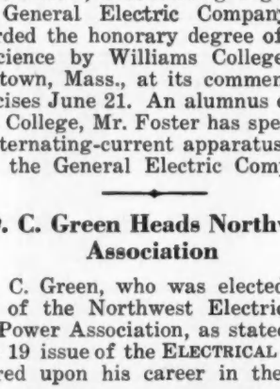
M. Luckiesh, director of the Lighting Research Laboratory of the National Lamp Works of the General Electric Company, Nela Park, Cleveland, was awarded the honorary degree of doctor of science by Iowa State College June 14.

Frank A. Mitchell, district manager in Chelsea for the Edison Electric Illuminating Company of Boston, has been transferred to the Dorchester district.

Dr. W. R. Whitney, director of the research laboratory of the General Electric Company, and **E. F. W. Alexanderson**, consulting engineer, who has gained international note through his radio inventions and developments, were both awarded the honorary degree of doctor of science on Monday, June 14, Dr. Whitney at Syracuse University and Mr. Alexanderson at Union College, Schenectady. **Anson W. Burchard**, chairman of the board of directors of the International General Electric Company and vice-chairman of the General Electric Company, received the degree of doctor of laws from Union College. **W. J. Foster**, a consulting engineer of the General Electric Company, was awarded the honorary degree of doctor of science by Williams College, Williamstown, Mass., at its commencement exercises June 21. An alumnus of Williams College, Mr. Foster has specialized in alternating-current apparatus design with the General Electric Company.

D. C. Green Heads Northwest Association

D. C. Green, who was elected president of the Northwest Electric Light and Power Association, as stated in the June 19 issue of the ELECTRICAL WORLD, entered upon his career in the public utility field as an employee of the San Diego Consolidated Gas & Electric Company following graduation from Purdue University in 1908. He remained with the Byllesby interests from that date until 1915, serving as manager of the commercial department of the San Diego property, manager of the Albany division of the Oregon Power Company, manager of the Coos Bay division of that company and later as manager of the Everett (Wash.) Gas Company.



D. C. GREEN

The year 1915 marked his first connection with the electrical properties in Salt Lake City in the capacity of manager of that division of the Utah Power & Light Company, but in less than two years he had rejoined the Byllesby organization as general manager of the Fort Smith (Ark.) Light & Traction Company, subsequently becoming vice-president and general manager. It was at the close of 1923 that he again affiliated himself with the Electric Bond & Share Company as vice-president and general manager of the Utah Power & Light Company and vice-president of the Utah Light & Traction Company. Mr. Green has long been active in association work, having been president of the Arkansas Public Utilities Association during his connection with the Fort Smith utility.

C. Heffner, formerly electrical superintendent at Ada for the Oklahoma Gas & Electric Company, has been transferred to Ardmore, where he will have charge of the electric department.

A. O. Parmelee of St. Petersburg, Fla., has been appointed district manager of the Pinellas County Power Company at Clearwater to succeed M. F. Treadwell.

Lieut.-Col. G. H. Whyte of the Calgary (Alberta) branch of the Dominion Water Power and Reclamation Service has been appointed to the position of assistant district chief engineer of the British Columbia and Yukon branch with headquarters in Vancouver, B. C.

George B. Sanford, formerly connected with the Great Western Power Company in Sacramento, has been appointed secretary and assistant treasurer of the Grays Harbor Railway & Light Company, Aberdeen, Wash., to succeed A. B. Doerr, resigned.

Loyall A. Osborne, president of the Westinghouse Electric International Company, was elected chairman of the National Industrial Conference Board at the tenth annual meeting of that organization in New York City. Mr. Osborne, who is a graduate of Cornell University, joined the Westinghouse organization immediately after leaving college and was made vice-president of the Westinghouse Electric & Manufacturing Company in 1902. He is now senior vice-president of that organization.

Ralph Neumuller, advertising and merchandising manager of the United Electric Light & Power Company, New York, was elected chairman of the Metropolitan New York Section of the National Electric Light Association at a convention held at the Hotel Commodore June 16. Mr. Neumuller has been associated with the electrical industry in New York since 1914, at first with the New York Edison Company, later as manager of the Electrical Publication Syndicate, publishers of the *Electrologue*, and more recently with the United Electric Light & Power Company. He has been vice-chairman of the Metropolitan New York Section in addition to holding numerous N.E.L.A. committee appointments.

Dr. John A. Fleming, British consulting engineer, has resigned the chair of electrical engineering at the University of London, which he had held for 41 years. The senate of the university accepted his resignation with regret and passed a motion eulogizing his services to science during that period. Dr. Fleming has been intimately associated with the development of all the great applications of electrical science in the last 25 years, including electric lighting, the telephone and wireless telegraphy, and he is the inventor of the thermionic valve which revolutionized wireless telegraphy and made wireless telephony possible. This is only one of the many inventions he has given to electrotechnics. He has been a prolific contributor to the proceedings of various technical and learned societies, including the Royal Society, the Physical Society, the Institution of Electrical Engineers and the Royal Society of Arts and in addition is the author of numerous textbooks or

treatises on electrical subjects. His scientific work has been recognized by election to a fellowship in the Royal Society in 1892, by the award in 1910 of the Hughes gold medal by the Royal Society, by the institution premium (twice) in 1903 and 1912 of the Institution of Electrical Engineers, by the Bernays prize of the Society of Engineers and by a silver medal from the Royal Society of Arts.

A. V. Wainright, formerly supervisor of Southern properties for the General Engineering & Management Corporation, has been transferred to that organization's new-properties department.

R. V. Gilchrist, who has been manager of the Vandalia (Ill.) plant of the Illinois Power & Light Company since that utility acquired the municipal plant, has resigned and will be succeeded by **F. A. Kuhl** of Greenville, Ill.

William I. Hall has been appointed district manager of the Edison Electric Illuminating Company of Boston, in the Brookline district. Mr. Hall has been associated with the Edison company for the past fifteen years.

Edward Dean Adams, engineer and financier, sailed for Europe June 23 aboard the Hamburg-American liner *Albert Ballin* for a vacation abroad. Mr. Adams is planning to spend two months in Europe, returning to this country late in August.

Albert H. Myers has resigned as chief engineer of Warren D. Spengler, Inc., Cleveland, to be an engineer in the hydraulic division of Stone & Webster, Inc., Boston. For several years Mr. Myers was engineer in the hydraulic turbine department of the Wellman-Seaver-Morgan Company, Cleveland.

Thomas F. English, vice-president of the Indiana & Michigan Electric Company, and **Guy M. Johnson,** South Bend manager for the Indiana Gas & Electric Company, were named directors of the South Bend Chamber of Commerce at the annual election. They will serve for two years.

H. C. D. Blanchard, hydraulic engineer of the New Brunswick Power Commission, has resigned. Mr. Blanchard was formerly construction engineer with the Ontario Hydro-Electric Power Commission and during his association with that body served as chief field engineer on the Queenston-Chippawa power development.

Clarence L. Law, chairman of the entertainment committee at the recent convention of the National Electric Light Association in Atlantic City and assistant to the vice-president in charge of commercial relations of the New York Edison Company, has undergone a serious operation at the New Rochelle Hospital, New Rochelle, N. Y. He has fortunately come through a very critical condition and is now well on the road to recovery.

John Stadler, formerly general manager of the Newfoundland Pulp & Power Company, has been chosen as general manager of the Mistassini Pulp & Power Company, which has recently been organized by a group of American and Canadian interests to operate in the Province of Quebec.

Charles V. Allen has been elected treasurer and assistant secretary of the Westinghouse Electric International Company to succeed H. A. Carmichael, resigned. Mr. Allen has a thorough acquaintance with the electrical export business and more than thirty years' direct contact with the manufacturing and sales division of the Westinghouse Electric & Manufacturing Company and the Westinghouse Electric International Company.

F. H. Daniels New President of Riley Stoker Corporation

Fred H. Daniels, who was elected president of the Riley Stoker Corporation to succeed the late R. Sanford Riley, as announced in the May 29 issue of the ELECTRICAL WORLD, brings to his new executive position an intimate knowledge of the company's business obtained through an association dating back to 1911, the year in which the company was organized. He served in the capacity of secretary for two years before he was advanced to the office of vice-president and general manager, the position he occupied until his recent promotion. The close relationship existing between Mr. Daniels and Mr. Riley during the leadership of the latter

F. H. DANIELS

enabled Mr. Daniels to acquaint himself thoroughly with the affairs of the company and made him the natural selection for the presidency.

Mr. Daniels was born in Worcester, Mass., and received his technical education at the Sheffield Scientific School, Yale University, and at the Massachusetts Institute of Technology. He spent one year with the B. F. Sturtevant Company, Hyde Park, Mass., before joining the Riley Stoker organization. Mr. Daniels is a vice-president of the Murphy Iron Works and of the Underfeed Stoker Company of America and in addition is a director of the Mechanics' National Bank, Worcester. He is a member of the American Society of Mechanical Engineers and of the Engineers' Club of Boston and the Engineers' Club of New York.

David Boyd-Smith, formerly assistant supervisor of Southern properties for the General Engineering & Management Corporation, has been elected general manager of the Alexandria division of the Virginia Public Service Company to succeed E. A. Feldtkeller, who has been assigned to the Florida-Georgia territory of that holding company. Mr. Boyd-Smith spent a brief period with the New York Edison Company before joining the staff of the General Engineering & Management Corporation as assistant supervisor of Southern properties.

Bruce H. Johnston, chief technical assistant to the advertising manager of the Canadian General Electric Company, Toronto, has been promoted to an executive position in the company's apparatus sales department.

Frank J. Boehm, vice-president of the Union Electric Light & Power Company of St. Louis, was elected president of the St. Louis Electrical Board of Trade on June 8. The election was held in conjunction with a luncheon given at the Hotel Statler.

R. L. McLellan, managing director of the Cia Westinghouse Electrica Internacional, S.A., of Argentina has recently been elected president of the United States Chamber of Commerce in Argentina. Following his graduation from Purdue University in 1907 he was employed by H. M. Byllesby & Company and the Merchants' Heat & Light Company, Indianapolis, before joining the Westinghouse company. Mr. McLellan is a member of the American Institute of Electric Engineers.

Obituary

W. D. Riggs, local manager of the Oklahoma Gas & Electric Company at Elk City, died June 13 at Oklahoma City from a diabetic coma. Mr. Riggs had been ill about two days. He assumed the position of local manager at Elk City about Jan. 15, 1925, and was well known among electric utility operating men in the state. He had been with the Oklahoma Gas & Electric Company since September, 1915.

Charles Griffith Young, consulting engineer of New York, died suddenly June 16 at the home of Adjutant General John A. Wilson near San Juan, Porto Rico. He had recently been in Santo Domingo in connection with an engineering project there. Mr. Young established a general consulting practice in connection with the financing, construction and operation of public utilities and industrials in this country, South America, Europe and Asia. A native of Bath, N. Y., he began his career with the Schuyler Electric & Manufacturing Company in Hartford and Middletown, Conn. From 1887 to 1892 he was general superintendent of the Mount Morris Electric Lighting Company, and from 1892 to 1909 he engaged in construction work for the White-Crosby Company, the J. G. White Company and other American and foreign corporations. Since 1909 he had been president of the C. G. Young Company, Inc., consulting engineers. Mr. Mr. Young was a fellow of the American Institute of Electrical Engineers and a member of the American Society of Civil Engineers, the Society of Automotive Engineers and the New York Electrical Society. In 1923 he became secretary to Richard E. Enright, at that time Police Commissioner of New York.

Commission Rulings

Relative Economy of Building Transmission Line and Buying Power Weighed. — The California Railroad Commission granted the application of the Great Western Power Company for authority to build a 22-mile, 44,000-volt transmission line in San Mateo County to supplement an inadequate existing line, at a cost of $156,000, although it was estimated by the commission's engineers that a connection could be made to the system of the Pacific Gas & Electric Company for $80,000. The permission was given on the contention that the construction would lessen the Great Western Power Company's operating costs and result in a saving through diversity of use. The responsibility for any unnecessary investment was, however, placed upon the management of the company, which was warned that the public should not be called upon to pay a return upon money so spent.

Benefits of Merger Under Proper Regulation.—In approving the merger of the properties, stock, earnings and franchises of the Blue River Power Company with those of the Nebraska Gas & Electric Company, both owned by the Continental Gas & Electric Corporation, the Nebraska State Railway Commission said that while the merger might narrow the competition when municipalities come to renew the contracts they now have with the Blue River company, it must be assumed that, as public utilities cannot capriciously or arbitrarily withdraw from a community, through the courts or elsewhere proper supervision of contract rates or rates without contract will exist. Mere size of a public utility corporation is not a reason for condemnation. Unified operation is generally advantageous, and in the case of electric utilities the opportunity for production of energy in large quantities at one place, with an attendant opportunity to sell it, is distinctly beneficial. Whether the benefits are corporate only or both corporate and public depends upon the spirit of the corporation and the efficiency of regulation. Mere possibility that these factors will be lacking is not sufficient reason to deny the application.

Integrity of Corporate Entities Not Lost by Common Ownership of Stock.—The Montana Public Service Commission, refusing to entertain a plea that rates at Ronan and Polson should be the same on the ground that the companies serving these places (the Flathead Valley Electric Company and the Mission Range Power Company) were under the same ownership, said: "We are not warranted in disregarding the integrity of corporate entities simply because stockholders and officers happen to be the same persons. Indeed, ownership of capital stock in one corporation by another (and nothing like that appears here) does not create an identity of corporate interests between the two companies, or render the stockholding company the owner of the property of the other, or create the relation of principal and agent or representative between the two. There must be some ground in addition to mere unity or interest and ownership. Even when two or more corporations are associated under common control, as several branches or departments of a single common enterprise, they are still normally to be regarded as separate and independent legal entities. It is true that the courts will not permit themselves to be blinded or deceived by mere forms of law, but, regardless of fictions, will deal with the substance of the transaction involved as if the corporate agency did not exist and as the justice of the case may require. In the present case, however, there is no implication that the stock ownership by the same persons in both corporations is for any other purpose than that of nominal participation in the affairs of both corporations in the usual manner."

Block-Rate Schedule Substituted for One Based on Connected Load.—The Wisconsin Railroad Commission granted to the Fort Atkinson Water, Light & Gas Commission the right to substitute a block-rate schedule for a schedule based on active connected load, the local authorities basing their request on the following grounds: "It is a burden and expense to handle a connected-load rate through the office record and in billing. There is too much confusion in billing where each consumer has different rating. It seems not only an unnecessary expense but an imposition to ask a consumer to give us access to his entire premises repeatedly to take connected-load ratings. It is impossible to convince the average lighting consumer of the justice of a rate which requires one to pay more for a certain number of kilowatts than his neighbor who has the same-sized house that he has or why he should be penalized for having or installing larger lamps or convenience outlets in his home." The state commission also passed upon the heating and cooking schedules and rural-service rates of the municipal plant, saying: "In order that the schedules taken as a whole shall not be unbalanced, it appears advisable to make the primary rate in the heating and cooking schedule the same as the primary lighting rate. . . . The rural rates authorized are not in line with those ordinarily approved for this class of service. In this case, however, it appears that such customers as are placed in the rural class have characteristics of urban customers in that they are served from the urban primaries owing to their location adjacent to the corporation limits. The differential per kilowatt-hour authorized, therefore, will probably take care of any excess elements of cost inherent in the service supplied outside the corporate limits and not found in urban service. If primary rural service is extended to any distance from the city limits, rural charges should be made effective. These charges will take care of all the excess fixed charges and operating expenses and will place rural customers on exactly the same basis as equivalent urban customers."

Recent Court Decisions

Measure of Damages for Destruction of Trees. — Barnes vs. Arkansas-Missouri Power Company was a suit to recover treble damages for the destruction of shade and ornamental trees on plaintiff's land. The jury had rendered a verdict for $500 as the actual value of the trees destroyed, and on motion this had been trebled under a statute providing such a penalty where trespass was involved. The Springfield (Mo.) Court of Appeals found that this statute did not apply to a case where the facts could lead a reasonably prudent person to believe he had the right to cut the timber—in the case at issue because of a permit from the State Highway Department—and it therefore ordered a refund of the exemplary damages of $1,000 or else a retrial of the suit in the light of the principle laid down by it. (281 S. W. 93.)*

Electric Company Responsible for Sagging of Wire Caused by Falling Branch in Unusual Storm.—Damages in $12,000 were found against the Tuolumne County Electric Power & Light Company, sued by Rocca, because of the death of a pedestrian on a public highway through contact with a sagging high-tension transmission line. The line had been forced within a few feet of the ground by the impact of a limb broken from a tree during an unusual storm. The California Court of Appeal sustained the finding, holding that the company was not relieved from liability because the tree was on private property and merely projected over the highway nor because the storm could not reasonably have been anticipated. The presumption of negligence was against the company for not guarding properly against danger reasonably to be apprehended, and the jury was the proper judge of the facts. (245 Pac. 468.)

Burden of Proving Confiscatory Rates Is on Utility Company Complaining.—The Pittsburgh & West Virginia Gas Company brought an action against the Public Service Commission of West Virginia in an effort to have the rates fixed for the gas company declared confiscatory. The Supreme Court of Appeals of the state, finding that the company was earning 16.72 per cent on the valuation made by the commission and accepted by the company—which, however, maintained that the real value was much higher and also that the commission gave no consideration to evidence of probably decreasing income—refused to upset the commission's order. The burden of proving confiscatory rates, the court said, is upon the complainant, and where it does not appear that the finding of fact is contrary to evidence or that there has been a misapplication of legal principles, the commission's finding will not be reversed. (132 S. E. 497.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Financial and Corporate

Utility Market Advances

American Water Works & Electric on Big Board Leads in Advance of Listed Issues

CONTINUED ease in the money market had its influence on the market both for investment and speculative securities, as was evidenced by the fact that during the week under review no fewer than fifty stocks listed on the New York Stock Exchange established new highs for the year. In the strong rise of the week the averages got to a position very close to the record peak established early in February, which is to say that the more prominent industrial and railroad stocks now have recovered most of the losses of the March recession.

While the improvement in power and light stocks has not been so marked or general, the tone of the trading nevertheless has materially improved, and advances were registered under the leadership of American Water Works & Electric Company which bettered its position during the week by more than five points. Columbia Gas & Electric and the North American Company also rallied on the big board.

A fifteen-point advance by Columbus Electric & Power on the unlisted market featured the advance, which for the most part did not exceed two or three points for individual stocks. Gains of two or three points were achieved by such issues as Northern Ontario Light & Power, American Light & Traction, Northern Texas Electric preferred and American Gas & Electric preferred. A pronounced rise was made by the Commonwealth Power warrants in sympathy with the rise in the stock, since the warrants theoretically are entitled to an advance of four points for each point gained in the stock.

Others that advanced were United Gas Improvement, American Gas & Electric, Cleveland Electric Illuminating preferred and Electric Bond & Share preferred.

New Capital Issues

Two important pieces of public utility financing were completed during the past week when the Ohio Power Company and the Cumberland County Power & Light Company successfully floated sizable loans bearing interest at the rate of only 4½ per cent. The Ohio Power issue was in the form of first and refunding mortgage gold bonds, series D, priced at 93 and accrued interest, to yield 4.95 per cent. These first and refunding mortgage bonds (of which $43,131,500 will be outstanding upon completion of the present financing) are secured by direct mortgage lien on the plants and properties of the company, valued at over $63,000,000, based on an appraisal made by Ford, Bacon & Davis in 1921, with subsequent additions at cost. Proceeds will be used to provide funds in connection with the purchase of important electric power and light properties in Ohio, to reimburse the company in part for capital expenditures already made under the terms of the mortgage and for other corporate purposes.

The Cumberland County Power & Light offering involved a total of $9,000,000 in first mortgage gold bonds, dated June 1, 1926, and due June 1, 1956, the price being 94½ and interest, yielding 4.85 per cent. These bonds will be secured by a direct first mortgage on all of the fixed property of the company. Based on an appraisal by independent engineers, the depreciated reproduction value of the mortgage is largely in excess of the principal amount of this issue, which, upon completion of the present financing, will constitute the only funded debt of the company. The purpose of this financing is to retire all bonds at present outstanding against the property of the company and its former subsidiaries (bearing interest rates higher than that of this series of first mortgage gold bonds), to reimburse its treasury for construction expenditures and to provide an adequate medium for future financing.

An additional issue of first refunding mortgage 5 per cent gold bonds, series B, of the Long Island Lighting Company, amounting to $1,500,000 appeared. The offering price was 100 and accrued interest. These bonds are followed by secured gold bonds amounting to $3,867,000, cumulative preferred stock amounting to $7,229,300 and by 300,000 shares of no-par-value common stock.

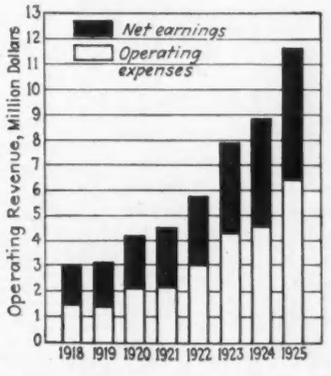
Recently the Central Illinois Public Service Company issued 5 per cent gold bonds amounting to $1,230,000 at 96 and interest, yielding 5.25 per cent. Proceeds will be used partially to reimburse the company for additions, extensions and improvements to its property and for other corporate purposes.

A block of 15,000 shares of the Interstate Power Company's $7 preferred stock was offered, the price being $95 per share and accrued dividend to yield about 7.37 per cent. Proceeds will be used to reimburse the company for expenditures for property additions and improvements and for other corporate purposes.

Alabama Power Unretarded by Drought

Company's 1925 Report Shows Continued Growth in Revenue, Connected Load and Customers Added—New Property Exceeds Thirteen Millions

THE annual report of the Alabama Power Company is of particular interest in view of the severe drought from which the Southeastern States suffered during 1925. The scarcity of water hampered all the companies in that territory, since under normal conditions they depend largely on hydro-electric power; but examination of this report shows that the Alabama Power Company not only met the emergency but showed a healthy growth in all ways. The operating revenues for 1925 were $11,589,419, as compared with $8,823,389 during 1924; the operating expenses for 1925 were $6,351,927, compared with $4,490,026 in 1924, and the net operating earnings were $5,237,481, against $4,333,364 in 1924. This represents an increase of 31 per cent in operating revenue during the year, with a corresponding increase in net earnings of 21 per cent, which is a very creditable record when the unusual conditions, necessitating the operation of all steam plants regardless of their efficiency, are considered.



GROSS AND NET OPERATING REVENUES OF ALABAMA POWER COMPANY

The connected load, number of customers served, energy sales and system demand all showed a large increase. The system is now serving more than 100,000 customers directly or indirectly, has a connected load of 535,649 hp., a system demand of 270,000 kw. and sold 918,532,426 kw.-hr. during 1925. It is of interest to note that 840 additional rural customers were connected during the year, making a total of 2,640 served, with 978 more promised service in the near future. Service was also extended to 48 additional towns and communities, many of which had not previously enjoyed electric service, and plans were laid to make extensions to 51 other towns.

To meet the energy demands caused by these increases the company hastened the work on hydro-electric projects already under construction and obtained state and federal authority to construct a new 180,000-hp. hydro-elec-

tric development at Lock 18 on the Coosa River. The Cherokee Bluffs plant was brought forward steadily and will probably be placed in service in July of this year with an initial capacity of 135,000 hp. and an ultimate capacity of 180,000 hp. This plant and the other developments on the Tallapoosa and Coosa Rivers not only serve as power supplies but by reason of their great storage capacity will provide 4½-ft. navigation on the Alabama River during most of the year and will minimize the effect of the river floods on the farms. The consolidated balance sheet shows that the cost of properties on Dec. 31, 1925, was $87,997,341, which includes an increase during 1925 of $13,221,275.

PHYSICAL GROWTH OF ALABAMA POWER COMPANY SHOWN BY SYSTEM DATA

	Energy Supplied, Millions of Kw.-Hr.	Maximum System Demand, Kw.	Maximum Available Capacity, Kva.
1918	401	86,850	136,375
1919	355	83,100	166,250
1920	488	97,900	168,500
1921	433	115,500	179,937
1922	607	153,100	250,437
1923	763	178,200	313,712
1924	823	189,050	354,965
1925	1,121	270,000	381,308

One section of the report is devoted to a summary of the merchandising activities and indicates that the company management is keenly alive to the necessity of developing the residence load. The report states, in fact, that the company's experience has shown "that while many small communities would not yield a sufficient revenue from lighting and power load alone to justify the capital expenditure, electric service is made possible through the returns from appliances." During 1925 748 electric ranges were sold, making a total of approximately 1,500 now in use.

The Alabama Power Company is noted for its constructive public relations, and its report reflects the work and care that has been expended along these lines. Every department of the company has had a part in building up the public confidence that the company enjoys. The engineering department has developed highly efficient methods of controlling malaria in connection with construction work on the great hydro-electric storage reservoir; the power sales and executive departments have carried out aggressive campaigns to attract new industries to Alabama, and the commercial department has carried out a large amount of educational work on the use of labor-saving appliances.

The accompanying chart and table show graphically the reward that such work brings with it.

Refinancing Profitable

Present Market Enables Utilities to Cut Fixed Charges—Nevada-California Issue a Typical Example

IN THE past year and a half a number of utility companies have taken advantage of the favorable market to simplify their financial structures and lower their fixed charges. A typical example of this was the sale on June 16 of $23,000,000 of Nevada-California Electric Corporation 5 per cent thirty-year first trust mortgage gold bonds to be followed by a later sale of $3,000,000 6 per cent fifteen-year debentures. The proceeds will be used to retire the $21,209,300 of mortgage bonds now outstanding, to defray the cost of new construction and for general corporate purposes. The 5 per cent bonds are issued under an open-end mortgage,

Stock Quotations of Electric Light and Power and Manufacturing Companies*

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Saturday June 19	Low 1926	High 1926
ABITIBI PWR. & PAPER, com.			
—no par	k 74½	70½	84½
Adirondack Pwr. & Lt.—7% pf.	k103	....	....
Adirondack Pwr. & Lt.—8% pf.	k113	....	....
Ala. Pwr., pf.	k107	....	....
Allis-Chalmers Mfg. pf.	k109	105	110½
Allis-Chalmers Mfg., com.	k 88	78½	94½
Aluminum Co. of Amer., com.	k 74½	54½	76
Aluminum Co. of Amer. new, pf.	k 99	....	....
Amer. & Foreign Pwr., pf. 25% pd.	m108	108	131
Amer. & Foreign Pwr., 7% pf.—no par	91	89	98
Amer. & Foreign Pwr., com.—no par	k 23½	15½	42½
Amer. Bosch Magneto, com—no par	k 23½	16	34½
Amer. Brown Boveri, Elec.	k 42½	30½	48½
Amer. Brown Boveri Elec pf.	96	86½	97½
Amer. Elec. pwr., pf.	m110½	102½	111½
Amer. Gas & Elec., 6% pf.—no par.	k 93½	....	....
Amer. Gas & Elec., com.—no par.	k 86½	64	99½
Amer. Lt. & Trac., 6% pf.	106½	105	115½
Amer. Lt. & Trac., com.	220	195	264
Amer. Pwr. & Lt., 6% pf.	k 94	92	96
Amer. Pwr. & Lt., com.—no par.	m 56½	50½	56½
Amer. Pub. Serv., 7% pf.	k 93	....	....
Amer. Pub. Serv., com.	47	45	80
Amer. Pub. Utilities, 6% pf.	k 85½	....	....
Amer. Pub. Utilities, 7% pf.	k 86	....	....
Amer. Pub. Utilities, com.	k 70	....	....
Amer. States Sec., A	k 3½	....	....
Amer. States Sec. B	k 2½	....	....
Amer. Superpwr., pf.—25.	k 25	23	26½
Amer. Superpower, pf.	91½	90	94
Amer. Superpwr., Class A—no par.	k 26½	19½	37½
Amer. Superpwr., Class B—no par.	k 28½	21½	39
Amer. Wtr. Wks. & Elec., 7% pf.	105	101½	108½
Amer. Wtr. Wks. & Elec., com.—20.	k 58½	43½	74
Anaconda Copper	k 48½	41½	51
Appalachian Pwr., 7% pf.	100	99	101
Appalachian Pwr., 1st pf., 7%	100	99	102
Appalachian Pwr., com.	80	80	83
Arizona Pwr., 7% pf.	k 70	....	....
Arizona Pwr., com.	k 20½	....	....
Arkansas Cent. Pwr., pf., $7—no par	k102½	....	....
Arkansas Lt. & Pwr., 7% pf.	k 98½	....	....
Arkansas Lt. & Pwr., com.	t 100	110	115
Asheville Pwr. & Lt., 7% pf.	l105½	100½	106½
Assoc. G.&E., pf.—$3.50—50	k 50	....	....
Assoc. Gas & Elec., pf.—$6—no par	k 91	....	....
Assoc. Gas & Elec., Class A—no par	k 30½	25½	35½
BABCOCK & WILCOX, com.	k116	....	....
Binghamton Lt., Ht. & Pwr., pf.	105	105	110
Birmingham Elec. pf.—$7—no par.	k105	....	....
Blackstone Valley Gas & Elec., pf.	103	103	106
Blackstone Valley G.&E., com.—50.	98	....	....
Blaw-Knox, com.	m 51	45	56
Brazilian Trac., Lt. & Pwr., com.	f 98½	....	....
Broad River Pwr., pf.	k 93½	....	....
Brooklyn Edison, com.	k141	133	146½
Buffalo, Niagara & East. Pwr., pf.—25	k 24½	....	....
Buffalo, Niagara & Eastern Pwr., com.—no par	k 27½	....	....
CALIFORNIA ELEC. GENERATING, pf.	93	89	95
California Ry. & Pwr., pf.	m105	88	115
Carolina Pwr. & Lt., pf.—$7—no par	k106	....	....
Cent. & S. W. Ut. 7% pf.—no par	a 92	89½	95
Cent. & S. W. Ut., pr. ln.pf.—no par	a 94½	93	100
Central Ariz. Lt. & Pwr., pf.	102	....	....
Central Ark. Ry. & Lt., 7% pf.	k 98	....	....
Central Ill. Pub. Serv., 6% pf.	k 88	89	91
Central Ind. Pwr., 7% pf.	88	87	93½
Central Pwr. & Lt., pf.	k 97½	....	....
Central States Elec., 7% pf.	k 92	....	....
Central States Elec., com.	m200	200	230
Century Elec. com.	b114	110	116
Chicago Fuse Mfg., com., no par.	a 31	30½	35
Cincinnati Gas & Elec., com.	g 89	88	93½
Cities Service, 6% pf.	86½	82½	86½
Cities Service, pf.B—10.	7½	7½	7½
Cities Service, pf. BB—100.	m 75	....	....
Cities Service, com.—20.	41½	37½	42½
Citics Service, Bks. Shrs.—10.	20½	19	20½
Clarion River Pwr., pf.	93	93	95
Cleveland Elec. Illg., 6% pf.	k107	....	....
Cleveland Elec., Illg., com.	k290	....	....
Colorado Pwr., 7% pf.	95	....	....
Columbia Gas & Elec., 7% pf.	114	112	115
Columbia Gas & E., com.—no par.	k 82½	63½	90
Columbia Ry., Gas & Elec., 6% pf.	90	65	96
Columbus Elec. & Pwr., 2d pf.	k103	....	....
Columbus Elec. & Pwr., com.	k265	....	....
Columbus Ry., Pwr. & Lt., 1st. pf.	k 98	....	....
Columbus Ry., Pwr. & Lt., pf. B.	k 94	....	....
Col. Ry., Pwr. & Lt., com.—no par.	k 85	....	....
Commonwealth Edison, com.	a142	137½	144
Commonwealth Pwr., 6% pf.	k 87	82	88
Commonwealth Pwr., com—no par.	k 39	28½	42½
Conn. Lt. & Pwr., 8% pf.	116	117	121
Conn. Lt. & Pwr. 7% pf.	107	108	113
Cons. Gas of N. Y., pf.—50.	k 58	....	....
Cons. Gas of N.Y., com.—no par.	k 97½	87	104½
Cons. Gas Elec. Lt. & Pwr. of Balti., 6% pf.	e103½	102	105
Cons. Gas, Elec. Lt. & Pwr. of Balti 6½% pf	e111½	108½	111½
Cons. Gas, Elec. Lt. & Pwr. of Balti. 7% pf.	e113½	109	113½
Cons. Gas, Elec. Lt. & Pwr. of Balti. 8% pf.	e127	124	128½
Cons. Gas, Elec. Lt. & Pwr. of Balti. com.—no par.	e 52	45	57½
Cons. Pwr. & Lt., 7% pf.	k105	....	....
Consumers Pwr., 6% pf.	k 98	....	....
Consumers Pwr., 6.6% pf.	k104	....	....
Continental Gas & Elec., 7% pfc. pf	k 97½	....	....
Continental Gas & Elec., 7% pr pf.	k 95½	....	....
Continental G.&E., com.—no par.	k130	....	....
Crocker Wheeler, com.	k 18	....	....
Crocker Wheeler, pf.	k 55	....	....
DALLAS PWR. & LT., 7% pf.	k105½	....	....
Dayton Pwr. & Lt., 6% pf.	k 99½	....	....
Detroit Edison, com.	k132	123½	141½
Dubilier Condenser & Radio, com. no par.	7	4½	11
Dubuque Elec., 6% pf.	94	93	98½
Duquesne Lt., 7% pf.	112	111	113
EAST. N. Y. UTIL. pf.	93	80	85
Eastern New York Util., com.	65	70	75
Eastern States Power.	k 14	....	....
Eastern States Pwr., pf.	k 87	....	....
Eastern Tex. Elec., 7% pf.	k103	....	....
East. Tex. Elec., com.—no par.	75	70	80
Edison Elec. Illum. of Boston, com.	d227	207	250
E. Paso Elec., com.—no par	70	70	94
E. Paso Elec. pf.	k102	....	....
Elec. Bond & Share, 6% pf.	l107	103½	107½
E. Bd. & Share Sec., com.—no par.	l 70½	56½	86
El. Household Util.	a 16	13½	25
Elec. Investors, 6% pf.—no par.	k 90	....	....
Elec. Investors, com.—no par.	k 41½	30½	74½
Elec. Investors, 10% pd. receipts.	20	12	56
Elec. Pwr. & Lt., ctfs., pf.	k 94½	89½	97½
Elec. Pwr. & Lt., ctfs., 40% pd.	103	99½	115
Elec. Pwr. & Lt., ctfs. full pd.	107	103	110½
Elec. Pwr. & Lt., ctfs., com.—no par	s 21½	15½	34½
Elec. Ry. Securities, com.—no par.	m6	4½	10
Elec. Refrig.	k 78½	62½	78½
Elec. Storage Battery, com.—no par.	k 85½	71½	85½
Elmira Wtr., Lt. & R. R., 7% pf.	98	97½	99½
Emerson Elec. pf.	m103	100	104½
Empire Dist. Elec., 6% pf.	80	80	85
Empire Pwr., A.	k 28	21	32
Eng. Pub. Serv., pf.—no par.	k104½	97	104½
Engr. Pub. Serv., com.—no par.	k 22½	21	29½
Eureka Vac. Cleaner, com.—no par.	k 52½	43	53½
FAIRBANKS MORSE, com—no par	51½	46	59½
Fairbanks Morse, pf.	111	108½	115
Federal Lt. & Trac., com.	k 31½	28	39½
Federal Light & Traction, pf.	86	86	89
Federal Utilities, pf.	k 70	....	....
Federal Utilities, com.	k 17	....	....
Ft. Worth Pwr. & Lt., 7% pf.	l107	105	108½
GALVESTON-HOUSTON ELEC., 6% pf.	k 42	....	....
Galveston-Hstn El., com.	k 13	....	....
Gen Elec., new	k 85½	79	87½
Gen. Elec., com.	k341½	285	386½
Gen. Elec., special—10.	k 11½	11	11½
Gen. G.&E., (Del.) com. A no par.	40½	34	52
Gen. G.&E., (Del.) com. B no par.	32½	28	49
Gen. G.&E., (Del.) A pf. $8—no par	109	105½	110½
Gen. G.&E., (Del.) A pf. $7—no par	98½	95	99½
Gen. G.&E., (Del.) B pf.	95	92½	96
General Public Service, pf.	m104½	90	106½
General Public Service, com.	m 13	12½	16½
Ga. Lt., Pwr & Rys., 6% pf.	86	82	86½
Ga. Lt., Pwr. & Rys., com.	m 57½	56½	73½
Ga. Ry. & Pwr., 8% pf.	k111	....	....
Ga. Ry. & Pwr., 7% pf.	k102½	....	....
Ga. Ry. & Pwr., 4% pf.	k125	....	....
Ga. Ry. & Pwr., com.	k125	....	....
Gt. Western Pwr., 7% pf.	h101½	....	....
HAVANA ELEC. UTIL., com.	35½	30	44½
Havana Elec. Util., pf.	m 75	64½	75
IDAHO PWR., 7% pf.	104	103	104
Ill. No. Utilities, 6% pf.	a 91	90	92
Ill. Pwr. & Lt., 7% pf.	k 98½	....	....
Ingersoll Rand	91	80½	104
*Int. Combus. Engr., com.—no par.	k 55	33½	64½
Int. Utilities, class A—no par.	k 32	31	39
Int. Utilities, class B—no par.	5½	4½	9½
Interstate Pwr., pf., $7 no par.	k 93	....	....
Interstate Pub. Serv., 7% pf.	97	96½	98
Iowa Ry. & Lt., 7% pf.	95	93	100
JERSEY CENTRAL PWR. & LT. 7% pf.	k 94	....	....
Jersey Central Pwr. & Lt., ptc. pf.	97	95½	98½
Jersey Central Pwr. & Lt., com.—no par	45	45	50
Johns-Manville, com.—no par.	k139	120	153

*Quotations on bonds will be published in the first issue of each month only.

Stock Exchange: aChicago; bSt. Louis; cPhiladelphia; dBoston; eBaltimore; fMontreal; gCincinnati; hSan Francisco; iPittsburgh; jWashington. kBid, low, high. Tuesday, June 22. lBid, low, high, Wednesday, June 23. mLatest quotations available. n1925.

Stock Quotations of Electric Light and Power and Manufacturing Companies (Continued)

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Saturday June 19	Low 1926	High 1926
KANSAS CITY PWR. & LT., pf.	115	107¼	112¼
Kansas Gas & Elec., 7% pf.	*l*101¼	99	102¼
Kentucky Hydro-Elec., pf.	*a* 93½	91½	95
Kentucky Sec., 6% pf.	80	75	85
Kentucky Sec., com.	*k*100	....	....
Kentucky Utilities, 6% pf.	92	90	95
Keystone Pwr. & Lt. 7% pf.	95	95	97
Kings County Ltg., 7% pf.	*k*103	....	....
Kings County Ltg., 8% pf.	103	105	108
LACLEDE GAS LT., com.	154	146	168
Lehigh Pwr. Sec., com.—no par.	*k* 15½	10	23
Long Island Ltg., 7% pf.	*k*107¼	....	....
Long Island Ltg., com.—no par.	115	120	150
Los Angeles Gas & Elec., 6% pf.	*k* 96½	....	....
Louisville Gas & Elec., Class. A.	*k* 24	22¼	26¼
MANHATTAN ELEC. SUPPLY.	*k* 77½	56	78
Manila Elec., com.—no par.	35	27¼	39¼
Maytag Mfg., com.	*k* 24	19	23¼
Memphis Pwr. & Lt., pf., $7, no par	104	103	107
Metro. Edison, pf.—$6—no par.	*k* 93	....	....
Metropolitan Edison, pf., $7, no par.	103	102	106
Metropolitan Edison, com., no par.	47	45	50
Middle West Utilities, 7% pf.	*a*107	97½	111½
Middle West Utilities, 7% pr. lien pf.	*a*115½	106¼	123½
Middle West Utilities, com.—no par.	*a*114½	108	134½
Midland Utilities, pr. in. pf.	*a*100	98	100½
Midland Utilities pf. A.	*m* 98½	96	98
Milwaukee Elec. Ry. & Lt., 7% pf.	101	....	....
Milwaukee Elec. Ry. & Lt., 6% pf.	93	....	....
Minn. Pwr. & Lt., 7% pf.	*l*103	100	104
Miss. Pwr. & Lt., pf.	*k*101	....	....
Miss. River Pwr., 6% pf.	*k* 95½	....	....
Miss. River Pwr., com.	*k* 60	....	....
Mohawk Hudson Pwr., 1st pf.—$7—no par.	*k*101	....	....
Mohawk Hudson Pwr., 2nd pf.—$7—no par.	*k* 95	....	....
Mohawk Hudson Pwr., com.—no par	*k* 24½	20½	28½
Montana Pwr., pf.	*m*114½	112½	119½
Montana Pwr., com.	*k* 78½	69¼	83½
Montreal Pwr., com.	*f* 228½	....	....
Mountain States Pwr., pf.	*k* 96	....	....
Mountain States Pwr., com.	*k* 20	....	....
NASSAU & SUFFOLK, LTG., pf.	*k* 95	....	....
National Carbon, pf.	*m*127½	125	128
National Elec. Pwr., pf.	92	93	95
National Electric Pwr-A	*a* 21½	19½	26
Nat.-Lt., Ht. & Pwr., com.—no par.	24	22	25
National Lt., Ht. & Pwr., 5% pf.	72	71	73
National Pwr. & Lt., pf., $7—no par.	*k*101	96	102½
National Pwr. & Lt., com.—no par.	*k* 23½	16¼	38½
National Pub. Serv., 7% pf.	*k* 92	....	....
National Pub. Serv., pfc. pf.	*k*100	....	....
National Pub. Serv., A com.—no par	*k* 19½	15½	24
National Pub. Serv., B com.—no par	12	10	12½
Nebraska Pwr., 7% pf.	*l*106½	103	107½
Nevada-Calif. Elec., com.	*m* 30	18¼	44½
New Brunswick Pwr., pf.	35	30	40
New England Pub. Serv., pr. in. pf..	97	98	99½
New England Pub. Serv., pf.	89	95½	97
N. J. Pwr. & Lt., 7% pf.	105	104	110
New Orleans Pub. Serv., 7% pf.	*k*101½	....	....
N.Y.& Queens Elec.Lt.& Pwr.,5% pf.	*k* 87	....	....
N. Y. Central Elec., 7% pf.	96	98	100
Newport News & Hampton Ry., Gas & Elec., com	110	108	112
Newport News & Hampton Ry., Gas & Elec., pf.	110	109	114
Niagara Falls Pwr., 7% pf.—25.	27½	27½	29
Niagara, Lock. & Ont. Pwr., 7% pf..	108	110	111½
No. Amer., 6% pf.—50.	*k* 51½	49	51
No. Amer., com.—10.	*k* 52	42	67
No. Amer. Edison pf.—no par.	*k* 96½	91½	96½
No. Amer., Lt. & Pwr., pf.	101	88	104
No. American Utilities, pf., full pd.	*m* 94½	89	96
No. American Utilities, pf., 25% pd.	*m* 19	18	27
N.C. Pub. Serv., pf.—$7—no par.	*k* 89	....	....
Northeastern Pwr., com.	*k* 19½	17½	36½
No. Indiana Gas & Elec., pf. A.	98	98	100
No. N. Y. Utilities, 7% pf.	*k*102½	....	....
No. Ohio Pwr., com.—no par.	*k* 13½	11	26½
No. Ohio Trac. & Lt., 6% pf.	78	78	81
No. Ohio Trac. & Lt., 7% pf.	85	88	91
No. Ont. Lt. & Pwr., pf.	*k* 83	....	....
No. Ont. Lt. & Pwr., com.	*k* 73½	....	....
No. States Pwr., 7% pf.	*k* 95	....	....
No. States Pwr. com.	*k*107½	97	136½
No. Texas Elec., 6% pf.	*k* 45	....	....
No. Texas Elec., com.	*k* 18	....	....
OHIO BRASS, com. B—no par.	74	70	79
Ohio Brass, pf.	100	98	101
Ohio Gas & Elec., 7% pf.	94	92	95
Ohio Pwr., 6% pf.	95½	93	95
Ohio Pub. Serv., 6% pf.	90	90	93
Ohio Pub. Serv., 7% pf.	*k* 99	....	....
Ohio River Edison, pf.	*k* 99½	....	....
Oklahoma Gas & Elec., pf.	*k* 96	....	....
PACIFIC GAS & ELEC., 6% pf.	*k* 98½	....	....
Pacific Gas & Elec. com.	*k*129½	118	132½
Pacific Pwr. & Lt., 7% pf.	*l*101	98	102
Parr Shoals Pwr., 6% pf.	92	....	....
Penn Central Lt. & Pwr., pf.—no par	*c* 72½	71	91
Penn-Ohio Edison, 7% pf.	*k* 95	....	....
Penn-Ohio Elec., 7% pf.	94	93	96
Penn-Ohio Pwr. & Lt., 7% pf.	96½	94	97
Penn-Ohio Pwr. & Lt., 8% pf.	102	100	106
Penn Pwr.&Lt.—$7—no par.	*l*107	103	108
Penn Pub. Serv., 7% pf.	101	96	100
Penn Pub. Serv., 6% pf.	85	85	90
Penn Wtr. & Pwr., com.	*c*145	141	171
Phila. Co., 6% pf.—50.	50	47½	50½
Phila. Co., com.—50.	72	59½	76½
Phila. Elec., com.—25.	*c* 49½	41½	67½
Pittsburgh Utilities, pf.—10.	19½	14½	20½
Portland Elec. Pwr., 7% pf.	*k* 98	....	....
Portland Elec. Pwr., 6% pf.	*k* 75	....	....
Portland Elec. Pwr., 6% 2d pf.	*k* 70	....	....
Portland Elec. Pwr., com.	*k* 37½	11	48½
Potomac Elec. Pwr., pf.	*j*109½	....	....
Pwr. Corp. of N.Y., com—no par.	*m* 79	77½	90½
Pwr. Sec., pf.—no par.	*k* 15	....	....
Pwr. Sec., com.—no par.	*k* 4	....	....
Pub. Serv. of N. J., 7% pf.	*k*106½	103½	108½
Pub. Serv. of N. J., 8% pf.	119½	115	120½
Pub. Serv. of N. J., com.—no par.	*k* 86½	72	92½
Pub. Serv. of No. Ill., 6% pf.	*a*104½	100½	104½
Public Serv. of No. Ill., 7% pf.	*a*115	112	116½
Pub. Serv. of No. Ill., com.—no par	*a*138	128½	138
Pub. Serv. of No. Ill., com.	*a*137	129½	136
Pub. Serv. of Okla., 7% pf.	95	92	95
Pub. Serv. Elec. & Gas, 6% pf.	100½	97	101½
Public Service Elec. Pwr., pf.	112	106	112
Puget Sound Pwr. & Lt., 7% pf.	*k*103	....	....
Puget Sound Pwr. & Lt., 6% pf.	*k* 83	....	....
Puget Sound Pwr. & Lt., com.	*k* 32½	28	66½
RADIO CORP. OF AM., pf.—50.	46½	44½	47½
Radio Corp. of Amer., com.—no par.	*k* 48½	32	46½
Republic Ry. & Lt., pf.	*k*106½	....	....
Republic Ry. & Lt., com.	*k* 85	....	....
Rochester Gas & Elec., 5% pf.	95	80	98
Rochester Gas & Elec. 6% pf.	*k*101½	....	....
Rochester Gas & Elec., 7% pf.	*k*105	....	....
SAN JOAQUIN LT. & PWR., 7% pf	97	97½	98½
St. Joseph Ry., Lt., Ht. & Pwr., pf.	65	60	65
Servel Corp., Class A	*k* 23½	15½	30½
Servel Corp., Class B—no par.	*m* 40	....	....
Sierra Pacific Elec., com.	*k* 27½	23	28½
Sioux City Gas & Elec., 7% pf.	*k* 97	....	....
S. E. Pwr. & Lt., pf.—$7—no par.	99	97	100
Southeastern Pwr. & Lt., pfc. pf.	64½	60	67½
S. E. Pwr. & Lt., com.—no par.	*k* 28½	20	46½
So. Calif. Edison, 8% pf.	140	135	140
So. Calif. Edison, 7% pf.	109	110	112
So. Calif. Edison, 6% pf.	98	97½	99
So. Calif. Edison, com.	*k* 31½	30½	32
Southern Cities Utilities, 7% pf.	*k* 89	....	....
Southern Cities Utilities, com.	*k* 44½	....	....
Southwestern Lt. & Pwr., A	*k* 60	....	....
Southwestern Lt. & Pwr., B	*k* 45	....	....
Southwestern Lt. & Pwr., $6 pf.	*k* 81	....	....
Southwestern Pwr. & Lt., 7% pf.	*k*101	....	....
Springfield (Mo.) Ry. & Lt., 7% pf.	95	....	....
Standard Gas & Elec., 8% pf.	*k* 54½	53½	57½
Standard Gas & Elec., 7% pf.	*k*102	....	....
Standard Gas & Elec., com —no par	*k* 56½	51	69
Standard Pwr. & Lt., 7% pf.	*k* 94	....	....
Staten Island Edison, pf.—$6—no par	*k* 95	....	....
Superheater, com.—no par.	*k*146	....	....
Syracuse Lighting, 7% pf.	102	105	107
Syracuse Lighting, 8% pf.	115	....	....
Syracuse Lighting, com.	300	260	315
TAMPA ELEC., com., new	*k* 50½	48	87
Tenn. Elec. Pwr., 6% pf.	*k* 88	....	....
Tenn. Elec. Pwr., 7% pf.	*k*101	....	....
Terre Haute, Ind. & East Trac., pf..	20	23	37
Terre Haute, Ind. & East. Trac., com	3	3	5
Tex. Pwr. & Lt., 7% pf.	*l*105½	102	106½
Tide Water Pwr., 8% pf.	*k*102½	....	....
Timken Roller Bearing, com—no par	*k* 52½	44½	56½
Toledo Edison, 8% pf.	113	112	114
Toledo Edison, 7% pf.	*k*102½	....	....
Toledo Edison, com.	100	....	....
Tri-City Ry. & Lt., 6% pf.	85	87½	89
UNITED GAS & ELEC., 6% pf.	*k* 96½	....	....
United Gas & Elec., com.—no par.	*m*57	56	66
United Gas & Elec. (N.J.), 5% pf.	*k* 70½	....	....
United Gas Impr.—50.	*c*109	84½	144½
United Lt. & Pwr., pf.—$4—no par.	*m* 48	....	....
United L. & P. pf.—$6.50—no par.	83½	81	91
United Lt. & Pwr., com. A —no par.	*k* 15½	12½	28
United Lt. & Pwr., com., B—no par new	*m* 18½	15	31
Utah Pwr. & Lt., 7% pf.	*l*102	99	103½
Utica Gas & Elec., 7% pf., ex. div.	*k*105	....	....
Utica Gas & Elec., com.	200	....	....
Utilities Pwr., & Lt., 7% pf.	*k* 92	....	....
Utilities Pwr. & Lt., com A	*m* 33½	28½	37
Utilities Pwr. & Lt., com. B—no par.	*k* 14½	14	18½
VERMONT HYDRO - ELEC., 7% pf.	94	95	96
Virginia Elec. & Pwr., 7% pf.	103½	101	103½
Virginian Pwr., 7% pf.	108	102	104
Virginian Pwr., com.	70	....	....
WAGNER ELEC., pf.	*b* 67	65½	85
Wagner Elec., com.—no par.	*m* 22½	20	34½
Washington Ry. & Elec., com.	*j*180	....	....
Washington Ry. & Elec., pf.	*j* 89	....	....
Washington Wtr. Pwr., com.	130	130	134
West Mo. Pwr., 7% pf.	*k* 91	....	....
West Penn., 7% pf. temp. ctfs.	*m*100	95½	101
West Penn, com.	*m*125	118	130
West Penn Elec., pf.	90½	95½	100½
West Penn Elec., Class A	94	88½	97
West Penn Pwr., pf.	111½	108	112
West Va. Lt., Ht. & Pwr., 7% pf.	95	95	98
West Va. Utilities, 7% pf.—50.	46	43	46½
Western Pwr., 7% pf.	*k* 95	91½	99
Western States Gas & Elec., 7% pf.	*k* 90½	....	....
Western States Gas & Elec., com.	*k* 16	....	....
Westinghouse El. & Mfg., com—50.	*k* 70½	65	79½
Weston Elec. Instrument, Class. A..	*k* 30	27½	31½
Weston Elec. Instrument, com.	*k* 16½	13½	19
Wheeling Elec., pf.	90	91	93½
Wis. Pwr., Lt. & Ht., 7% pf.	90	85	90
Worthington Pump, pf. A.	73	68	80
Worthington Pump, pf. B.	60	53	65
Worthington Pump, com.	*k* 32½	20½	44½
YADKIN RIVER PWR., 7% pf.	*l*105½	102	106½
Yale & Towne, com.—25.	*k* 67	60½	69

Stock Exchange: *a*Chicago; *b*St. Louis; *c*Philadelphia; *d*Boston; *e*Baltimore; *f*Montreal; *g*Cincinnati; *h*San Francisco; *i*Pittsburgh; *j*Washington. *k*Bid, low, high, Tuesday, June 22. *l*Bid, low, high, Wednesday, June 23. *m*Latest quotations available. *n*1925.

$50,000,000 being authorized at present, and will constitute, in effect, a first mortgage on all the fixed properties, since all the outstanding bonds of the subsidiary companies and $16,455,800 (99 per cent or over) of the capital stocks of the subsidiaries will be deposited as security with the trustee.

Without going into all the details of the costs of this refinancing, an approximate idea may be gained of the advantages to the company. The annual fixed charges on the $21,209,300 in 6 per cent bonds retired were $1,272,558. The redemption premiums amounted to $697,549. Adding this to the amount of bonds retired gives $1,906,849, on which interest at 5 per cent amounts to $1,095,342.45. Disregarding bond discounts and selling expenses, which it is reasonable to suppose are at present less than at the time the original bonds were issued and should, therefore, be largely cared for by present amortization provisions, the company saves $177,215.55 in annual fixed charges.

The Nevada-California Electric Corporation is only one of several companies which have readjusted their financial structures. Several of them profited more because they had been forced to finance at the exorbitant rates of 1920-21 and the present market offered them opportunities to cut the interest rate on their funded debt from 1½ to 1¾ per cent.

Company Reports

Name of Company	Gross Earnings for May 1926	1925
Central Maine Power System..	371,317	372,044
Cities Service	2,328,364	1,960,819
Detroit Edison*	3,437,152	2,884,138
Florida Power & Light	1,275,380	698,874
Idaho Power†	230,342	221,058
Massachusetts Lighting	299,219	281,961

* Includes other revenue. † April.

Public Service Stockholders Reach New High.—Stockholders carried on the books of the Public Service Corporation of New Jersey on June 1, 1926, totaled 53,000, a figure representing a new high record. The number of stockholders is increasing rapidly as a result of the customer-ownership campaign now in progress. Since April 1, 1926, when the present stock sales campaign started, the company has sold approximately $3,000,000 of its 6 per cent cumulative preferred stock. The present 53,000 stockholders represent a gain of 2,260 per cent over the 2,249 stockholders as of Dec. 31, 1920.

Rollins & Sons Celebrate Anniversary.—June 16 marked the fiftieth anniversary of the founding of E. H. Rollins & Sons, investment bankers. This house has been identified with the financing of electrical projects from the very beginning of the electrical industry, having provided the capital for the construction of one of the earliest alternating-current electric lighting plants in the United States. From its first office in Denver, the company has expanded to 38 offices in the United States and one in London. E. W. Rollins, who established the firm, is still chairman of the board.

Big Utility Strengthened by New Loan

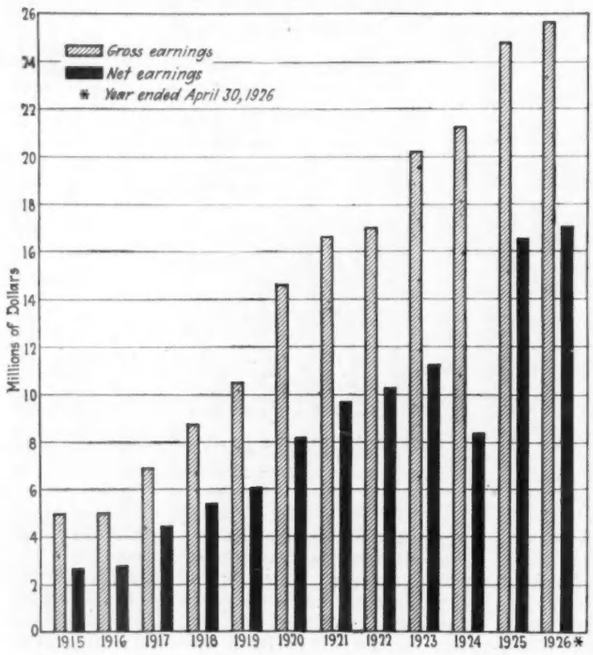
Southern California Edison's Forty-Million-Dollar Issue of 5's Will Enable It to Retire $33,919,000 General and Refunding 6 per Cent Bonds

BY PAUL WILLARD GARRETT
Financial Editor *New York Evening Post*

ADVANTAGE of the favorable money market has been taken by the Southern California Edison Company in its flotation of a forty-million-dollar issue of refunding mortgage 5 per cent bonds due in 1951. The greater part of the funds received by the company will be used to retire at 105 approximately $33,919,000 of general and refunding mortgage 6's. The new financing thus will benefit the company from two standpoints: (1) It will replace a bond on which the company must pay interest at the rate of 6 per cent for one that bears only 5 per cent coupons, and (2) it will bring the company's "working mortgage" closer to the property. The latter point needs some explanation.

The refunding mortgage under which the new bonds have been issued is at present the company's "working mortgage." It is the one through which the management expects to do its future senior financing. The old general and refunding mortgage was effective as a medium of senior financing for only six years, since expansion in operations in that time had exhausted the amount of bonds issuable under the mortgage. Accordingly a new mortgage, the refunding mortgage, was created in 1923 with a present authorized issue of $250,000,000, which can be increased by the action of the stockholders and board of directors. As one authority expresses it in summarizing the benefits of the new loan: "As a part of this financing $33,919,000 of the underlying 6 per cent bonds will be retired, which will simplify the capital structure of the company, will represent a reduction of 40 per cent in the amount of underlying bonds outstanding and in addition will result in a saving of interest."

On completion of the present financing the capital structure of the Southern California Edison Company will be simplified. Its total outstanding bonds will aggregate $118,018,700 and its total outstanding capital stock $96,988,497. Of bonds there will be $49,553,700 in underlying bonds, all secured by closed mortgages; a $1,965,000 issue of 7 per cent debentures, an issue of $26,500,000 refunding mortgage 6's due in 1943 and the new forty-million-dollar issue of 5's due in 1951. Of stock there will be $4,000,000 in original 8 per cent preferred stock, $24,290,275 in preferred B 6 per cent stock, $25,180,850 in preferred series A and an issue of $43,517,372 in common stock on which dividends now are being paid at the rate of 8 per cent.



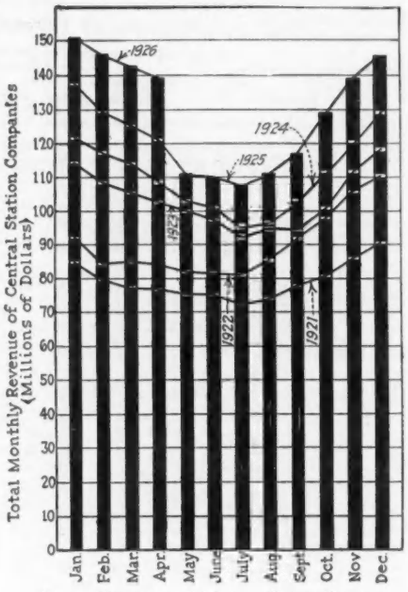
GROSS EARNINGS OF SOUTHERN CALIFORNIA EDISON SHOW CONSISTENT GROWTH

Earnings have grown in spectacular fashion from a total in gross of $445,110 in 1902 to an aggregate of $25,653,217 for the twelve months ended April 30, 1926. Net earnings available in the latter period for interest, depreciation, dividends and other charges were $17,129,906. Annual interest charges on the $118,018,700 of bonds presently to be outstanding total $6,288,840. That is to say, on completion of the present financing and on the basis of present earnings Southern California Edison Company should earn its interest requirements two and seven-tenths times. It is the splendid earnings record of the company that enabled the bankers to market the new bonds on so favorable a basis. The bonds were sold at a price to yield 5.10 per cent to investors.

Revenue Shows Substantial Gain Over Last Year

Reports received by the ELECTRICAL WORLD from central-station systems representing 75 per cent of the generator rating of this industry indicate that the total gross revenue from the sale of energy during April was $139,800,000, or a daily average of $4,660,000, an increase of 14.0 per cent over April of last year. During April the gross revenue was 5.4 per cent above the estimated normal for that month based upon the operations of the industry during the past five years.

The operating expenses during April totaled $56,500,000.



APRIL REVENUE 14.0 PER CENT OVER LAST YEAR

Dividends Declared

The quarterly dividends listed below have been announced by electric light and power and electrical manufacturing companies:

Name of Company	Per Cent	When Payable
Abitibi Power & Paper, pf	1¾	July 2
Alabama Power, pf	1½	July 1
American Brown Boveri Elec., pf	1¾	July 1
American Brown Boveri, pfc. stk.	.50	July 20
Arkansas Central Power, pf	$1.75	July 1
Central Power & Light, pf	$1.75	Aug. 2
Century Electric	1½	June 22
Chickasha Gas & Elec., com	2	July 1
Chickasha Gas & Elec., pf	1½	July 1
Cincinnati Gas & Elec	1½	July 1
Cities Service, com.*	½	Aug. 1
Cities Service, com. †	½	Aug. 1
Cities Service, pf. and pf. B	½	Aug. 1
Coast Valleys Gas & Elec., pf. A	$1.50	July 1
Coast Valleys Gas & Elec., pf. B	$1.75	July 1
Electric Public Service, pf	1¾	July 1
El Paso Electric, (Del.), pf. A	1¾	July 15
El Paso Electric, (Del.), pf. B	1½	July 15
El Paso Electric, (Tex.), pf. A	1¾	July 15
El Paso Electric, (Tex.), pf. B	1½	July 15
Georgia Ry. & Power, 7% pf	1¾	July 1
Illinois Power & Light, 7% pf	1¾	July 1
Iowa Power & Light, pf	1¾	July 1
Massachusetts Lighting, com	.75	June 30
Massachusetts Lighting, 6% pf	1½	July 15
Massachusetts Lighting, 8% pf	2	July 15
Memphis Power & Light, pf	$1.75	July 1
Midland Utilities, pr. In	1¾	July 6
Midland Utilities, pf. cl. A	1¾	July 6
Missouri Power & Light, 7% pf	1¾	July 1
Nevada-Calif. Elec., pf	1¾	Aug. 2
North American Lt. & Pwr., 7% pf.	1¾	July 1
Northern Ohio Pwr. & Lt., 7% pf	1¾	July 1
Ohio Edison, 6% pf	$1.50	Sept. 1
Ohio Edison, 6.6% pf	$1.65	Sept. 1
Ohio Edison, 7% pf	$1.75	Sept. 1
Ohio Edison, 6.6% pf.*	.55	July 1
Ohio Edison, 6.6% pf.*	.55	Aug. 2
Ohio Edison, 6.6% pf.*	.55	Sept. 1
Philadelphia Co., com	$1	July 31
Public Service Co. of Okla., com	2	July 1
Public Service Co. of Okla., pr. In	1¾	July 1
Public Service Co. of Okla., pf	1½	July 1
Republic Ry. & Lt., 6% pf	1½	July 15
Southern Indiana Gas & Elec., 6% pf	$1.50	July 1
Southern Indiana Gas & Elec., 7% pf	$1.75	July 1
Southwest Power, pf	1¾	July 1
Superior Water, Lt. & Pwr., pf	1¾	July 1
Turners Falls Pwr. & Elec., com	$2	June 30
United Gas & Elec., com	$1	June 19
Wagner Electric, pfd	$1.75	July 1
Washington Water Power	2	July 15

* Monthly. † Payable in common stock.

Manufacturing and Markets

American Industry and Taxation

Third Article in a Series Discussing the Industrial Aspects of Certain Broad Economic, Political and Social Considerations Now Prominent

BY JAMES A. EMERY
General Counsel National Association of Manufacturers

AMERICAN industrial development is intimately related to American taxation. And this is especially true of the electrical industry, for the development and application of power to manufacture, to transportation and to household service are all dependent upon ample supplies of capital. The greatest evil of disproportionate and extravagant public expenditure is that it takes from a people too great a share of that surplus which constitutes the sole fund out of which to expand and develop their individual and social life.

Prior to the World War our taxes were negligible. Then within a brief period we hastily erected a collecting structure which took in revenue and left in debt a sum in excess of the total cost of American government from its birth to our entrance into the tragic struggle. The war cost us forty billion dollars, a sum equal to the total net earning power of the manufacturing corporations of the United States over a ten-year period. We raised that colossal sum partly by loans from our people and partly by direct taxation. We face now an annual debt of substantially twenty billion dollars, which we are retiring at the rate of a billion a year. The interest upon this requires 40 per cent of federal revenue, but federal taxes have now fallen to about $3,250,000,000 for the current fiscal year, with a promise of further reduction.

But we are citizens of the states as well as the nation. We support state, county, municipal and smaller units of local government. Our tax bill is the current expense and the interest upon the debt of all these forms of government. Neither may tax the securities emitted by the other, and each may exempt its own paper from any form of levy.

THE AGGREGATE TAX

The taxpayer is therefore meeting, in addition to the requirements of interest and sinking-fund charges upon $20,000,000,000 of national debt, similar charges upon $1,558,000,000 of state bonds and $10,000,000,000 of city, county and other local indebtedness. While the tax requirements of federal government have fallen from substantially $6,000,000,000 to approximately $3,000,000,000 per year, the sums required for the current operation of state government have increased from $570,000,000 in 1919 to $1,064,000,000 in 1924, while city and local taxes have increased from annual demands for $2,395,000,000 in 1919 to substantially $4,000,000,000 in 1925. The total of federal, state and local taxes now aggregates $8,000,000,000 annually. Their total expenditure, made up of revenues from other sources and the proceeds of loans which represent deferred taxation, approximates $10,000,000,000. The indebtedness of state and local government is rising at the rate of a billion a year, which equals the annual reduction of the national debt, while the current taxation of the states and localities has risen annually in excess of the reductions in taxation made by the national government.

What do these figures signify? They mean that our state and local indebtedness is greater than the annual value of the crops raised upon the six and a half million American farms. They mean that the net income of the manufacturing corporations of the United States does not provide the funds required for state and local government, nor would that be met by all the money in circulation in the United States.

WHO PAYS THE BILL?

The great volume of federal revenue is obtained from individual and corporate income, while more than 90 per cent of state and local taxes fall upon

Value of Electrical Exports for April, 1926, Compared with Corresponding Month in 1925

(Issued by Bureau of Foreign and Domestic Commerce)

Articles	April 1925	April 1926
Generators:		
Direct-current:		
Under 500 kw.	$91,387	$65,651
500 kw. and over	5,000	54,534
Alternating-current:		
Under 2,000 kva.	54,416	118,957
2,000 kva. and over	39,393	
Steam-turbine generator sets	4,637	50,991
Accessories and parts for generators	42,586	95,249
Self-contained lighting outfits	95,384	98,836
Batteries:		
Flashlight batteries	137,126	123,718
Other primary batteries	92,215	186,958
Storage batteries	315,494	333,465
Transforming or converting apparatus:		
Power transformers	254,510	133,029
Other transformers	148,524	159,481
Rectifiers, double-current and motor generators, dynamotors, synchronous and other converters	158,484	63,937
Transmission and distribution apparatus:		
Switchboard panels, except telephone	326,733	288,166
Switches and circuit breakers over 10 amp	113,583	289,180
Fuses and fuse blocks	24,123	27,923
Watt-hour and other measuring meters	60,307	45,526
Volt, watt and ampere meters and other recording, indicating and testing apparatus	177,049	161,804
Lightning arresters, choke coils, reactors and other protective devices	47,504	76,885
Motors, starters and controllers:		
Motors under 1 hp	193,658	168,475
Stationary motors:		
1 to 200 hp	174,362	294,595
Over 200 hp	66,404	109,777
Railway motors	56,341	47,368
Electric locomotives:		
Railway	5,860	322,596
Mining and industrial	18,618	111,965
Starting and controlling equipment:		
For industrial motors	128,250	112,128
For electric railway and vehicle motors	3,609	19,000
Portable electric tools	*	56,782
Accessories and parts for motors	161,064	242,749
Electric appliances:		
Electric fans	64,999	108,787
Electric lamps:		
Metal filament	127,183	132,158
Other electric lamps	18,989	27,680
Flashlights	131,260	241,340
Searchlights and projectors	56,474	34,097
Motor-driven household devices	$131,691	$161,114
Domestic heating and cooking devices	150,291	120,618
Industrial electric furnaces and ovens	8,598	27,615
Therapeutic apparatus, X-ray machines, galvanic and faradic batteries, etc	107,754	129,256
Signal and communication devices:		
Radio apparatus	853,148	†
Transmitting sets and parts	*	37,654
Receiving sets	*	111,692
Tubes	*	69,406
Receiving set components	*	149,704
Receiving set accessories	*	127,069
Telegraph apparatus	54,442	72,695
Telephone apparatus:		
Magneto telephones	10,141	19,569
Other telephones	35,815	59,156
Telephone switchboards	122,523	42,065
Other telephone equipment	173,829	326,086
Railway signals, switches and attachments	107,880	104,237
Bells, buzzers, annunciators and alarms	16,902	35,046
Other electric apparatus:		
Spark plugs, magnetos and other ignition apparatus	173,785	260,806
Insulating material	141,082	154,467
Metal conduit, outlet and switch boxes	79,929	85,140
Sockets, receptacles and lighting switches	147,987	154,524
Electric lighting fixtures, interior and street	103,091	271,894
Other wiring supplies and line material	157,887	114,299
Other electrical apparatus not elsewhere stated	597,048	672,185
Rubber and friction tape	*	34,235
Globes and shades for lighting fixtures	37,557	43,416
Electrical glassware except for lighting	27,539	48,057
Electrical porcelain:		
For less than 6,600 volts	64,498	104,556
For 6,600 volts and over	179,756	54,943
Carbons, carbon brushes and electrodes:		
Electrodes for electric furnaces	85,117	191,302
Other carbon products	169,141	109,832
Insulated wire and cable (iron and steel)	54,210	11,604
Copper, bare wire	148,037	230,127
Copper, insulated wire and cable	448,150	532,376
Total electrical machinery and apparatus and supplies	$7,773,354	$9,070,533

* Not separately stated prior to Jan. 1, 1926
† Discontinued from Jan. 1, 1926

real property. Substantially 7½ per cent of our population makes an income tax return, and about 3½ per cent have been paying an income tax. But does this mean that a handful of our people or our business organizations pay the cost of government, that many sit at the public table but a few sign the check? Such a delusion undoubtedly exists. Indeed, the constant demand for new and expensive services from government indicates a widespread belief that all may enjoy its benefits and a few may be made to carry the expense. It is an amazing illusion, for taxation is our social overhead. It represents the cost of living under organized government. It is as much of a fixed charge as any other element of cost in production or service and is unavoidable. It is written into food, clothing, shelter, light, heat, distribution, communication, every commodity sold and every service performed.

And yet we approach the taxpayer with a bill in one hand and a tax-exempt security in the other, while lifting the rate to possessors of large income to a point where it is more profitable to permit capital to loaf in a place of refuge from public burdens than accept, without hope of proportionate return, the risks of business investment. This has been the cardinal sin of our system.

But the industrial system we have established and developed and the maintenance of our prevailing standards of life consume for their support an increasing amount of all we produce. To conserve our producing power is our first task. To increase our surplus that we may have proportionate means to renew our economic machine, conduct experiment, enlarge established enterprise and develop new processes and the means of meeting ever-increasing wants and a steadily enlarging population is the price of progress.

TAXES VERSUS SURPLUS

What, then, is our taxable capacity? Government, national, state and local, is consuming annually 12 per cent of the total national income. That would mean that for six weeks every year the nation labored exclusively for the state. That in itself is startling, but it understates the fact, for probably three-fourths of the national income is consumed in sustaining the commodities and services which represent that resultant. Taxes, however, are not paid from gross income. They are the first charge against the net result. They are a necessary limitation upon what we may otherwise spend or save.

Taxes are a compulsory, not a voluntary contribution. It is only what is left after we consume to sustain our individual and economic life that is available for betterment. It is not the product of the farmer's fields which measure his prosperity; it is what is left after expenses are met and taxes are paid which permits him to renew or increase his tools, enlarge his acreage, improve his stock, repair his buildings and put something aside for sickness, old age and enlarged opportunities for his children. It is what is left after operating expenses are met which permits a railroad to enlarge its facilities and improve its service. It is not the $48,000,000,000 which measures the progress of the 63 per cent of manufacturing corporations that alone show a net income, but the $4,250,000,000 of profit which gives them the means of sustaining and expanding the service they render to the American people. What is true of the individual or of business is true of the nation. It moves forward only through the savings of self-denial and thrift, with the aid of those margins above our individual or collective consumption.

Our taxable capacity as a people, then, is not the difference between that 12 per cent we expend for government and the value of our gross production of commodities and services. It is the difference between what we produce and what we consume. It is the sum we may safely take from that average 25 per cent of surplus without imperiling the size and stability of that fund through which we meet the requirements and provide the improvements of our future. It is time to reflect upon the stunning fact, not that government demands one-eighth of our income, but that it is absorbing perhaps one-half of our surplus.

INDUSTRY'S RESPONSIBILITY

The remedy for our condition is both individual and collective. We need to establish a tax consciousness which will make each citizen feel the nature and extent of our public burdens and their effect upon the conservation and expansion of our life. We must face the obligation to draw the line between parsimony and extravagance in public expenditure. We must provide not merely budgetary safeguards to the smallest taxing unit and enforce them, but we may profit by the successful experiment introduced by the Governor of Minnesota requiring administrative officials to justify to a qualified administrative control the actual expenditure of appropriated money. We must lessen the demand upon government for new services and aids.

The Secretary of Commerce has enumerated and described 200 bureaus, boards and commissions operating within the federal government without any system of organized relationship. A similar condition undoubtedly exists in many of our state, municipal and county organizations. They present a fruitful field for practical reorganization, which can be effected only by the people of each state and community in terms of their own knowledge of local requirements and conditions. The hour is ripe, not merely for the reduction of rates, but for the intelligent reconstruction of our taxing system, and since American industry provides so great a share of the money there rests upon the industrial executive a responsibility for initiative and leadership in effecting this reform.

Sales Statistics on Direct-Current Motors

Orders entered for direct-current motors during the month of April showed a falling off of 28.8 per cent as compared with the preceding month, when sales were at an exceptionally high rate. The sales and billings for the first four months of 1926 are shown in the accompanying table and include control equipment sold with the motors.

ORDERS ENTERED AND SALES BILLED FOR DIRECT-CURRENT MOTORS

(1-hp. to 200-hp. inclusive, built in general-purpose motor frames, including control equipment sold with motors.)

(Issued by Electric Power Club.)

Month, 1926	Orders Entered	Billings
January	$852,630.15	$961,269.23
February	900,785.73	840,189.77
March	1,218,985.02	1,082,669.39
April	866,868.52	821,946.62
Year to date	$3,839,269.42	$3,706,075.01

Business Conditions

MANUFACTURERS report the receipt of a number of orders for power equipment. A contract was signed for a 215,000-hp. turbo-generator unit at a cost of approximately $1,750,000. Seven waterwheels and generators purchased for a water-power development in Maryland amounted to $3,500,000. Electrification of textile mills, as well as the building of new plants, is active in the Southeast, and the prospect of a good cotton crop has resulted in several inquiries for transmission-line material, transformers and motors for cotton gins. New oil fields recently exploited in northwestern Oklahoma and the extreme north Texas have created an active demand for motors and other drilling and pumping equipment.

Indications are that total sales in the industry for the first six months of this year will be slightly lower than for the same period last year. However, manufacturers see no prospect of a falling off, but rather expect a steady business at the current rate throughout the remainder of this year.

In the New England district sales are holding up well, and continued strength is being shown in the purchases of motors, central-station supplies and heavy power equipment. Electric ranges are in active demand, particularly in Maine and southeastern Massachusetts. Buying is in steady volume in the New York district, with central-station companies active buyers of diversified equipment. In the Southeast many new industrial projects are under consideration, and contracts were let this week for the construction in Georgia of a 30,000-spindle textile mill and 200 houses for the mill village, representing an outlay of approximately $500,000. Transmission-line materials are also in brisk demand. Sales show a steady increase in the St. Louis district. Several medium-sized orders were placed for substation equipment to be used in the southwestern part of Missouri. An increas-

ing trend is noted in sales in the Middle West and optimism is prevalent. Central-station companies are busy with construction work in that territory. On the Pacific Coast buying by industrial plants, mills and utility companies was outstanding, orders for line materials have been especially good, and contractors have been placing better orders than at any time in the last two months.

Buying Slackens in Metal Markets —Prices Easier

With the exception of tin, recessions in prices in London occurred in all the major non-ferrous metals and these were reflected in the domestic market. Tin was active on Monday and Tuesday and a net increase in the price is noted. The leading interest has not changed its price for lead but premium prices that prevailed a week ago are no longer in evidence in New York even for prompt shipment. The tonnage of copper that changed hands during the week is less than for any week since early in May. With one or two exceptions producers have no metal for July shipment and they are maintaining an asking price of 14 cents delivered in the East.

Last Thursday was an unusually active day for lead, consumers apparently being anxious to buy before the Smelting company made another advance. The tendency in London, however, was downward until Wednesday, so that much of the apprehension concerning price increases in the domestic market has been removed. Business has fallen away to a considerable extent, and in the last day or two it has been below normal. The contract price of the American Smelting & Refining Company continues at 8¼ cents. A moderate business was done in zinc since last week Thursday at 7.10 cents and 7⅛ cents, but with London prices firmer the domestic situation has stiffened somewhat. The tin market has been generally quiet, though much more interest has been exhibited since Tuesday noon and the price on prompt Straits has advanced to 62 cents. Consumers and traders have both entered the market and taken a fair tonnage, particularly for July and August delivery.

NEW YORK METAL MARKET PRICES

	June 16, 1926 Cents per Pound	June 23, 1926 Cents per Pound
Copper, electrolytic	14.025	13.925
Lead, Am. S. & R. price	8¼	8¼
Antimony	10⅝	11⅛
Nickel, ingot	35	35
Zinc spots	7.525	7⅛
Tin, Straits	61	62
Aluminum, 99 per cent.	28	28

Base copper price June 23, 1926, 16 cents.

Increasing Trend Noted in Sales in Middle West

Business transacted in the Middle West indicates a slightly increasing trend and optimism is prevalent. Building construction of a high value is in progress and more work is in view. Industrial plants are steadily operating and in most cases report a slight gain over the previous week. An interesting announcement was made of the merger of the activities of three large utility companies. Central-station companies are busy with construction work, one in the Chicago district making an addition to its present plant at a cost of $1,250,000. Among the interesting orders placed were one for 15,000 condenser tubes, another for vertical feed water heaters, and another for a quantity of 132-kv. switches. There was a good demand for pole line hardware and high tension insulators. Jobbers' sales were somewhat better this week. Fan sales were quite substantial but the unfavorable weather conditions have retarded sales considerably. Washing machines are moving well, one jobber placing an order for 500 machines this week.

Buying in Steady Volume in New York District

Buying in the New York district continues steady and in fair volume, with one order reported for a 215,000-hp. turbo-generator unit costing about $1,750,000. In the industrial field control manufacturers report an increase in the volume of sales, particularly of small-sized equipment. Small motors are also in good demand, and considerable interest is being evidenced in the larger sizes, although sales are slow. Central-station buying of diversified equipment is steady, and the total volume of this business is good. A decrease in the demand for switching equipment is indicated by manufacturers, although poles and line hardware are active. Jobbers report a fair market for appliances, but state that building construction materials are inactive.

Industrial Plants and Utilities Active on Pacific Coast

Industrial plants, mills and utility companies have been purchasing in good volume on the Pacific Coast. Line-material orders have been especially good, and wiring supplies have been selling better with noticeably better orders placed by inland contractors. A lumber company purchased 235 motors, ranging from 1 hp. to 350 hp., for a new mill in Idaho. This contract involved an expenditure of more than $100,000. Several lumber companies making additions to existing plants also placed orders for from three to ten motors. A shingle mill is in the market for $6,000 worth of motors, and a lumber mill in Mason County is expected to place orders for electrification equipment at an early date. Oil companies have purchased several motors, and a manufacturer reports the receipt of an order for 220 fractional-horsepower motors for oil-burning equipment.

Forty motors were purchased for irrigation purposes in the Yakima district, and the city of Tacoma will probably award contracts this week for high-tension pole switches, choke coils, transformers, etc. The city of Seattle is in the market for a large quantity of copper wire and has also awarded a contract for 4,000 4,500-volt insulators. Some orders have already been placed for a street-lighting system covering several blocks in downtown Seattle. Power-company purchases have also included a pole order for $20,000, 5,000 lb. copper wire and 125,000 ft. guy strand. Contractors are placing better orders than at any time in the last two months. Purchases are fairly large and well assorted, and reveal that stocks have been depleted to the very minimum. A 50,000-ft. order for No. 14 rubber covered wire, $2,000 worth of condulets and 2 carloads of conduit are outstanding items.

Sales in the New England District Holding Up Well

Much encouragement prevails in the New England district owing to the continued strength shown in the sales of motors, central-station supplies and more recently in the movement of heavy power equipment. During the past week interest centered in the awards for electrical equipment for a large water-power development in Maryland, of which an order for four waterwheels and control amounting to about $1,000,000 was placed with one company. Other orders covered three similar waterwheel units and the seven generators to be driven by these turbines. In New England also activity in hydro-electric developments is quite strong and a number of projects are under consideration.

Small-motor sales are in good volume. One manufacturer reports orders amounting to about $30,000 for additions and replacements in New Hampshire and Rhode Island; another records a normal week with a number of lot orders. Central-station supplies and equipment are in good demand, and many orders are being received from eastern Maine, southeastern Massachusetts and eastern Massachusetts. Small-appliance sales are good; safety switches are moving in good volume, and there is considerable demand for control apparatus and socket devices. Household-appliance sales improved during the past week, and according to a well-known manufacturer are gaining in strength throughout the district. Electric ranges are in very active demand in Maine and southeastern Massachusetts. In the latter section thirty-five units were recently sold by one central-station company.

Many Industrial Projects Under Consideration in Southeast

Sales in the Southeast is very satisfactory, but there are no single large orders reported. A feature of the week was the announcement by the Shipping Board that the South Atlantic ports would be allowed freight rates equal to those of the ports of the North, and this action will undoubtedly result in important expenditures for additional port facilities south of Norfolk. Contracts were let this week for the construction in Georgia of a 30,000-spindle textile mill and the erection of 200 houses for the mill village, which work will represent an outlay of approximately $500,000. Other new industrial projects and plans for electrification of existing plants are under consideration, and definite announcements regarding several are anticipated within the near future. Preparatory to the coming ginning season are the reported good orders for motor equipment for gins in localities heretofore without

electric service, and inquiries are being made on similar equipment for mechanically driven oil mills. Transmission-line materials continue in brisk demand, and there is some evidence of the substitution of cypress poles for the creosoted pine variety in order to obtain more prompt deliveries. Several orders were placed for aluminum conductor on long-span lines particularly designed for supply of service to rural communities and isolated industrial plants.

Central-station campaigns are sustaining the very satisfactory volume of range and appliance sales, one company having disposed of 1,100 flatirons in one week with three days of the campaign yet to run. There is also a tendency on the part of large central-station companies to undertake house-wiring activities in the small communities on their systems to provide adequate wiring facilities in the homes and commercial establishments in those towns, and this activity bids fair to stimulate materially wiring device sales. Residential and commercial lighting fixtures are reported active, one large fixture dealer stating that this line shows more life than for many months past. Electric signs are also responding to the sales activities of central-station companies, and reasonably satisfactory orders for various sizes and types of signs are reported, with the outlook for an increased activity in this line during the summer months.

Sales Show Steady Increase in the St. Louis District

Several medium-sized orders for substation equipment were closed in the St. Louis district. This material is to be shipped to operating companies in the southwestern part of Missouri. Manufacturers say that the good prospect for a cotton crop in Oklahoma and Arkansas has already brought several inquiries, especially for transmission line materials, transformers and motors to operate cotton gins. The opening of the new oil field in northwestern Oklahoma and extreme north Texas has created an active demand for motors and other equipment for drilling and pumping oil wells. Wire and cable manufacturers say that while no very large orders have been placed during the past week, the small orders have been coming in regularly and keeping the total well above last year's mark. Jobbers report business to be holding up remarkably well in most lines and it is maintaining a lead over last year's sales.

Activities of the Trade

Twenty-Million-Dollar Delco-Light Plant

New Facilities Will Enable Company to Manufacture 600,000 "Frigidaire" Units Annually—Still Further Expansion Contemplated

TWENTY million dollars will be expended within the next six months by the Delco-Light Company in the expansion of its Frigidaire division at Moraine City, about 4 miles from Dayton, Ohio, it is announced by E. G. Biechler, president and general manager of the company. This expansion program, which has been caused by the company's electric refrigerator business outgrowing the existing manufacturing facilities in Dayton, means that five thousand additional men will be employed, and with the new plant the Delco-Light company will have a production capacity of 600,000 electric refrigerator units a year, more than doubling its present output.

President Biechler in commenting on his company's expansion program said:

"It is just as impossible today to determine definitely the future of the electric refrigeration industry as it was twenty years ago to gage correctly the tremendous market about to open for the automotive industry. We have already broken ground for a twenty-million-dollar plant which will be in production early in 1927 and which will bring our next year's output of electric refrigerators to 600,000. This is approximately double our estimated 1926 production. May shipments from the Delco-Light plants had a retail sales value of $11,250,000. Shipments for the same month in 1925 were slightly more than $4,000,000, and although "Frigidaire" sales in June and July will probably be much higher than in May, there is but scant opportunity for heavier production as overtime double shifts have been the rule for some months.

"The present 'Frigidaire' plant will be operated to full capacity for the remainder of the year in an effort to provide dealers with stocks for the beginning of 1927 and to supply the foreign demand, which has been much neglected owing to the urgency of the domestic demand. Our 1926 building program is designed only to meet our estimated sales requirements for 1927. The General Motors Corporation, of which the Delco-Light Company is a subsidiary, has already indicated its willingness to invest $100,000,000 if necessary in the future development of this industry. From a sales analysis we have made of the electric refrigeration field we find there is a potential market in the United States alone for 14,000,000 household electric refrigerators. This is the number of dwellings in the United States with electricity, and although only about half of them are now using any kind of refrigeration at all, this is perhaps the big end of the industry in the future.

"The present market is overshadowed by the commercial demand. Retailers of food, drug stores, ice-cream dealers and others present a market for two million electric refrigeration units. Such dealers are ready prospects because the electric refrigerator appeals to them on a basis of saving, service and convenience. Next in importance as we have found it is the apartment-house market. Builders of apartment houses have found it necessary to supply electric refrigeration to get tenants, and owners of apartment houses have found it necessary to install electric refrigeration in order to hold their present tenants. Taking care of the commercial demand and of that arising from apartment houses, together with what household demand presents itself, will take up our production for at least another year. By that time the household market, we believe, will be sufficiently developed to tax our manufacturing facilities again."

American Brown Boveri Company Consolidates Subsidiary Plants

The Railway & Industrial Engineering Company, Greensburg, Pa., manufacturer of transmission, switching and protective equipment, is consolidating its plant with that of the Electrical Development & Machine Company, Philadelphia, manufacturer of the "Franklin" line of power equipment. The Railway & Industrial Engineering Company, which recently purchased property adjoining its plant, as announced in the May 22 issue of the ELECTRICAL WORLD, is enlarging its plant facilities, and a new building under construction will be occupied by the Electrical Development & Machine Company, which will move its plant from Philadelphia.

This move will combine the manufacture of outdoor and indoor switching equipment under one head, and is expected to be complete by August 1. B. W. Kerr is president of both companies and H. B. Austin is vice-president. The sales effort of both companies will be co-ordinated throughout the country.

Ajax Electrothermic Moving to New Plant at Ajax Park

The Ajax Electrothermic Corporation is now moving into its new plant at Ajax Park, Trenton, N. J., adjacent to the new Ajax Park station, formerly the Fernwood station of the Reading Railway, and plans to be completely installed in it by July 1. In this new plant the company states that it will have improved facilities for developing and manufacturing its high-frequency induction furnaces. The company expects to build for laboratories furnaces which will be smaller and less expensive than those which were formerly marketed. It is also building larger furnaces for melting, heat treating, annealing, etc., and plans to manufacture both ferrous and non-ferrous alloys for special purposes.

The Sangamo Electric Company, Springfield, Ill., announces that since June 1 Reginald M. Campbell, special representative, with headquarters at 50 Church Street, New York City, has been assigned complete management of all watt-hour-meter business in the metropolitan district. Mr. Campbell will be assisted in this new arrangement by

W. S. Boult. T. B. Rhodes will continue in charge of radio and ampere-hour-meter sales as well as the service department.

Utica Products, Inc., Utica, N. Y., announces that it has greatly improved its Utica electric portable furnace both in appearance and efficiency.

The Superior Insulating Tape Company, 3046 Lambdin Avenue, St. Louis, announces the appointment of C. D. Myers, Temple, Tex., as its representative to the jobbing trade in the state of Texas.

The Buffalo Fuse Corporation, 752 Main Street, Buffalo, N. Y., manufacturer of Pierce renewable fuses, announces a change in name to the Pierce Renewable Fuses, Inc. The company also announces that the Ingham-Gillingham Corporation, 51 Barclay Street, New York City, has been appointed its agent for the metropolitan district.

The Lapp Insulator Company, Inc., Le Roy, N. Y., announces that the Van Rosen Company, 141 Milk Street, Boston, has been appointed its representative for New England. Other manufacturers represented by the Van Rosen Company include Delta-Star Electric Company and Packard Electric Company.

The Monitor Controller Company, Baltimore, manufacturer of automatic controllers and electrical resistors, has opened a branch office at Room 417, 136 Federal Street, Boston, in charge of Nelson A. McCoy. For the past eight months Mr. McCoy has been in the main office of the company and prior to joining the Monitor organization was with the Wagner Electric Corporation for fifteen years.

The Coldak Corporation, 8 West Fortieth Street, New York City, manufacturer of Coldak electric refrigerators, has appointed T. Herman Vetterlein as its distributor for Philadelphia and eastern Pennsylvania. Mr. Vetterlein is president of the Refrigeration Company Inc., 717 North Broad Street, Philadelphia.

The American Circular Loom Company, 90 West Street, New York, manufacturer of "Loomflex" flexible conduit and "Xduct" galvanized conduit, announces the appointment of R. W. Mitscher in charge of its Buffalo office at 332 Delevan Avenue. The Buffalo office serves New York State with the exception of New York City and the Hudson Valley south of Albany.

The Master Electric Company, Linden & Master Avenues, Dayton, Ohio, motor manufacturer, announces the opening of its own district office at 1725 Brandywine Street, Philadelphia. The company states that a stock of motors will be carried at that office to serve the district and that both the office and the warehouse facilities will be in charge of William F. Grau.

The Parr Electric Company, Inc., 77 Warren Street, New York City, jobber, announces the formation of the Parr Electric Export Company, Inc., for the purpose of taking over the export department of the Parr Electric Company and also for the purpose of acting as export sales manager for electrical manufacturers. The officers of the new company are: McKew Parr, president and treasurer; C. E. Merrill, secretary; George M. Parr, assistant secretary, and Joseph McElroy, 3d, general manager. Max John Schmitt, who has previously been connected with the export department of the Parr Electric Company, will join the new organization in charge of service and traffic.

The Westinghouse Electric and Manufacturing Company announces appointment of F. E. Eldredge as commercial manager of the radio department to succeed E. B. Mallory. Mr. Eldredge will make his headquarters at the East Pittsburgh works of the company and will also have an office in the Westinghouse Building, 150 Broadway, New York.

The Johns-Pratt Company, Hartford, Conn., announces that it has added to the "Noark" line three general utility switches, which have been designed to meet the demand for small rugged switches with fuse protection.

The Appleton Electric Company, 1701 Wellington Avenue, Chicago, manufacturer of "Unilets" and other conduit fittings, announces the removal of its New York office and warehouse to 150 Varick Street. The new office and warehouse comprises approximately 11,000 sq.ft. floor space and gives the company considerably more room for stock which will enable it to take care of its Eastern trade. The New York office is under the supervision of F. H. Merrill, vice-president and Eastern sales manager, and in New York City are L. P. Swick and W. H. Chambers, district representatives.

The Wagner Electric Corporation in announcing a quarterly dividend of $1.75 on the preferred stock, payable July 1, stated that the net earnings of the company this year were much larger than during the same period last year and that the future bookings were highly gratifying. One of the directors expressed the opinion that the corporation is in better shape than it has been in for a number of years.

Pass & Seymour, Inc., Solvay Station, Syracuse, N. Y., manufacturer of wiring devices, is offering a new line of porcelain ring receptacles with identified loop terminals.

The Lincoln Electric Company, Cleveland, announces that the Cleveland Tool & Supply Company has been appointed local distributor for its full line of Lincoln motors and "Stable-Arc" welders.

New Equipment Available

High-Speed Diesel Engine

A high-speed Diesel engine, with a speed range up to 900 r.p.m. and having characteristics that include light weight, small room space, ability to burn cheap fuel oil economically, close governing, ability to carry overload and simplicity, has been developed by the Foos Gas Engine Company, Springfield, Ohio. The new engine is known as the type "L" Foos Diesel, and while it embodies certain elements of design peculiar to itself, in general it is a reproduction in miniature of the engineering principles of fuel injection and combustion that distinguish the slow-speed, solid-injection type "R" Foos Diesel engine. The new Diesel finds application to all drives for which the use of comparatively high-speed gasoline engines have been common. The engine is of the vertical, multi-cylinder type, operating on the full-Diesel, four-stroke cycle, with airless injection of fuel. It is built in from two-cylinder to eight-cylinder units with a power range from 50 hp. to 475 hp. The engine is completely inclosed and is provided with automatic lubrication throughout, using full pressure feed to all bearings. Each cylinder of the engine is equipped with an air starting valve and starts on less than 250 lb. air pressure. The weight of the engine is from 60 lb. down to 30 lb. per horsepower.

Meter-Test Block

A knife-switch meter-test block made up in unit form and which allows making any combination of poles in any order desired has been placed on the market by the States Company, 13 New Park Avenue, Hartford, Conn. The blocks consist of potential and current units so arranged as to fit side by side to form the desired number of poles. A test jack may be used when it is desired to connect a rotating standard to the customer's line without interrupting service. With this type of block the company states that it is impossible to open the circuit on a current transformer through the fault of the operator in leaving any part of the switch open. All the switch-type test blocks are furnished with metal covers and can be had for either front or back connections.

Crane Truck with Lifting Magnet

For unloading loose castings from box cars a small crane truck equipped with a lifting magnet has been developed by the Baker-Rauling Company, Cleveland. The crane is known as the type S-477 and has a capacity of 1,000 lb. at a 40-in. radius. An automatic cut-off opens the hoist motor circuit when the magnet reaches the top of the travel, and an automatic interlock which is controlled by the brake pedal opens the travel motor circuit when the operator leaves the driving platform or releases the foot pedal. The hoist and magnet controllers are directly in front of the operator, and the hoist may be slewed by means of the conveniently located handles. A lock is provided to retain it in the central position.

The power for operating the travel and hoisting motors as well as the magnet is supplied by a gas-electric unit manufactured by the Ready-Power Company, Detroit. The unit consists of a compound-wound ball-bearing generator with a maximum output of 250 amp. at 30 volts, hooked by means of a silent chain to a four-cylinder Continental engine governed at 1,000 r.p.m. The magnet is the 20-in. circular type manufactured by the Ohio Electric & Controller Company of Cleveland and is designed to operate on 1,320 watts.

New Trade Literature

THRUST BEARINGS. — The Marlin-Rockwell Corporation, Gurney Ball Bearings Division, Jamestown, N. Y., has issued a booklet covering the "M-R-C" thrust bearings. Data sheets, dimensions, loading ratings, price lists, etc., are included.

STREET-LIGHTING AND DISTRIBUTION EQUIPMENT.—The Line Material Company, South Milwaukee, Wis., has published its sectional catalog No. 26, covering its street lighting and distribution equipment, including street-lighting fixtures (ornamental and scientific), lamp posts and bracket fixtures, Hood's multiple street-lighting system, lightning arresters, service racks, cross-arms, fiber conduit, underground material, etc. Illustrations are given showing various street-lighting installations, lamps and lamp standards. Charts showing comparative curves, calculations on horizontal illumination, comparative data on three general types of series street-lighting construction, and installation suggestions are included.

ELECTRIC PORTABLE FURNACE.—A folder issued by the Utica Products, Inc., Utica, N. Y., describes and illustrates the Utica electric portable furnace.

GROUND RODS.—The Copperweld Steel Company, Braddock Post Office, Rankin, Pa., is distributing a revised leaflet containing data on Copperweld non-rusting ground rods.

ARC WELDING.—The General Electric Company, Schenectady, N. Y., has issued bulletin GEA-423, entitled "Arc Welding in G-E Factories," which calls attention to the economic advantages secured through the many applications of electric welding, such as lower cost and improvement in quality in product and increase in production, etc. For reference this publication is divided into five sections—manufacturing and miscellaneous processes, tank manufacturing, factory furniture and fixtures, salvage and repairs, and structural steel. It contains numerous illustrations showing various applications of the arc-welding machine.

INDUSTRIAL REFLECTORS. — The Pittsburgh Reflector Company, 304 Ross Street, Pittsburgh, has issued a bulletin describing and illustrating the new Pittsburgh reflector, No. 1-1,000, designed for use with 300, 500, 750, 1,000 and 1,500-watt incandescent lamps, for high-mounting industrial lighting and lighting through skylights.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

Purchase is desired in Berlin, Germany (No. 20,813), of portable telephones and telephone cable. An agency is also desired for internal-combustion engines (No. 20,800.)

Purchase is desired in Bergen, Norway (No. 20,197), of elevators.

An agency is desired in Folgno, Italy (No. 20,801), for refrigerating and ice-making machinery.

Purchase and agency is desired in Sydney, Australia (No. 20,967), for batteries for automobiles; also an agency (No. 20,943), for electric washing machines. ranges, vacuum cleaners, refrigerators, air pump for garages, tools and small hoist.

Purchase and agency is desired in Stockholm, Sweden (No. 20,981), for electric hair-curling irons.

An agency is desired in Paris, France (No. 20,941), for electrical appliances and equipment (clothes and dishwashing machines), electric motors and lighting appliances; (No. 20,898), for internal-combustion engines and boilers; (No. 20,896) for machine tools and precision tools.

An agency is desired in Para, Brazil (No. 20,928), for electrical supplies.

An agency is desired in Oporto, Portugal (No. 20,942), for electrical supplies for motor-car installations.

CABLE FOR MONTEVIDEO, URUGUAY.—Bids will be received by the Administration General de las Usinas Electricas del Estado, Montevideo, Uruguay, until July 26 for 22,500 meters (14 miles) of 6,600-volt and a like amount of 220-volt cable. Two copies of specifications, which are in Spanish, have been received by the Electrical Equipment Division, Bureau of Foreign and Domestic Commerce, Washington, D. C., and will be lent to American firms in the order in which requests are received. Refer to number Uruguay-EE1016.

ELECTRIC PLANT TO BE INSTALLED AT PERNIK, BULGARIA.—The administrative council of the state mine at Pernik, Bulgaria, according to *Commerce Reports*, has decided to build an electric plant at the mine equipped with two turbo-generators of 4,000 kw capacity each.

PORCELAIN INSULATORS AND PINS FOR MONTEVIDEO, URUGUAY. — The Administration General de las Usinas Electricas del Estado Montevideo, Uruguay, will receive bids until Aug. 5 on porcelain insulators of various types and iron pins. A copy of specifications with blueprints has been received by the Electrical Equipment Division, Bureau of Foreign and Domestic Commerce, Washington, D. C., and will be lent to firms interested. Refer to number Uruguay 212,060.

AUTOMATIC SWITCHING EQUIPMENT FOR AUSTRALIA.—Specifications have been issued by the Victorian Railway Commissioners of Melbourne, Australia, inviting bids until Sept. 1 on automatic switching equipment for the Elwood substation. Copies of the specifications will be lent by the Electrical Equipment Division, Bureau of Foreign and Domestic Commerce, Washington, D. C., to firms interested. Refer to number Australia 210,974.

DISK-TYPE INSULATORS FOR AUSTRALIA.—Bids will be received by the State Electricity Commission of Victoria, Melbourne, Australia, until Aug. 23 for disk-type insulators. Copies of specifications are on sale at the New York district office, 734 Custom House, and the Chicago district office, 76 West Monroe Street, Bureau of Foreign and Domestic Commerce.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

CAMBRIDGE, MASS.—Plans have been filed by the Cambridge Electric Light Company for an equipment storage and distributing building to cost about $17,000.

LEOMINSTER, MASS.—Plans are under consideration by the City Council to replace the present lighting system in Monument Square and to extend the area. To carry out this plan fifty-three ornamental lamps of 1,000-cp. would be required.

WESTPORT, MASS.—The voters have authorized the Selectmen to contract with the Fall River (Mass.) Electric Light Company to install and maintain electric lamps on the old New Bedford, Blossom, State and Sanford Roads, for a term of five years, the cost not to exceed $2,500 in any one year.

WEST SPRINGFIELD, MASS. — The Board of Selectmen has authorized the installation of an arc-lighting system on Westfield Street, extending to Sykes Avenue.

Middle Atlantic States

JAMESTOWN, N. Y.—The Board of Public Utilities is negotiating for the purchase of the local substation and system of the Niagara, Lockport & Ontario Power Company. If acquired, extensions and improvements will be made for municipal service.

LONG ISLAND CITY, N. Y.—Steinway & Sons, 109 West Fifty-seventh Street, New York, plan to install electric power equipment in their proposed plant at Ditmars Avenue and Fifteenth Street, to cost about $750,000.

NEW BRIGHTON, N. Y.—The United States Gypsum Company plans to install electric power equipment in a proposed new plant unit, to cost about $200,000.

NEW YORK, N. Y.—Bids will be received by the New York State Bridge and Tunnel Commission and New Jersey Interstate Bridge and Tunnel Commission at the office of the Commissions, Room 3,004, Woolworth Building, until July 20, for furnishing and installing equipment for lighting the tunnels, approaches, plazas and ventilation buildings; also furnishing and installing traffic signals, telephones, switchboards for control of oil switches and motors, control and power wiring, 440-volt truck type oil switches, distribution transformers, operating and protective relays carbon monoxide recording apparatus, a complete supervisory system, etc., known as contract No. 19 of the Holland Tunnel. For details see Searchlight Section.

NORTHPORT, N. Y.—Bids will be received by the United States Veterans Bureau, Room 791, Arlington Building, Washington, D. C., until July 27, for construction of buildings and utilities at the United States Veterans' Hospital, Northport, Long Island, Separate proposals will be received for building construction, plumbing, heating, concrete oil tank and oil burners, electrical work, elevators, ice-making and refrigerating plant and brick chimney.

TUCKAHOE, N. Y.—Contract has been awarded by the Westchester Lighting Company, Mount Vernon, for the construction of a substation here, to cost about $125,000.

UTICA, N. Y.—Work has started by the Adirondack Power & Light Corporation, Schenectady, on the erection of a 110,000-volt transmission line from Utica to Inghams, a distance of 20 miles. The cost is estimated at $400,000.

NORTH BERGEN, N. J.—The Gibraltar Corrugated Paper Box Company, 91 Seventh Avenue, New York, plans to install electric power equipment in its proposed plant on the Hackensack Plank Road, to cost about $350,000.

ALLENTOWN, PA.—The Pennsylvania Power & Light Company plans to extend its transmission line from Alberts to Mountain Top, Pine View and vicinity.

MERCER, PA.—The Mercer County Light, Heat & Power Company, Greenville, is securing a right-of-way for extensions in its transmission line to furnish service to additional industrial plants in this district.

READING, PA.—Extensions to the ornamental lighting system on North Pitt and West Louther Streets has been approved by the City Council.

RICHMOND, VA.—Plans for rebuilding the plant of the Virginia-Carolina Rubber Company, recently destroyed by fire, with a loss of about $100,000, include a power plant.

WINCHESTER, VA.—The local substation of the Northern Virginia Power Company was recently damaged by fire.

WASHINGTON, D. C.—Bids will be received by the Purchasing Agent, Post Office Department, Washington, until June 28, for one air compressor outfit.

North Central States

DETROIT, MICH.—The United States Gypsum Company, 205 West Monroe Street, Chicago, plans to install electric power equipment in its proposed local mill, to cost about $200,000.

WHITTEMORE CITY, MICH. — The Whittemore Light & Power Company, recently organized, contemplates the construction of a local power plant. Charles McKenzie heads the company.

ALLIANCE, OHIO — Plans of the Alliance Tank Company for the erection of a new factory building include a power plant and the installation of electrically driven machinery.

CANTON, OHIO—Plans are being prepared by the Stark Electric Railroad Company for extensions and improvements in its power plant, including the installation of additional equipment, to cost about $85,000.

CLEVELAND, OHIO—Steps have been taken by the Thirtieth Ward Merchants' Association for the installation of ornamental lamps on Kinsman Road S. E.

CLEVELAND, OHIO—Bids will be received at the office of the Commissioner of Purchases and Supplies, Room 226, City Hall, until June 30, for 6-volt 11-plate, 6-volt 13-plate, 6-volt 15-plate, 12-volt 7-plate, 12-volt 9-plate, 12-volt 11-plate, storage batteries, covering all the city's requirements on lighting and starting storage batteries for a period of one year. Plates on the above batteries to be ¼-in. thick.

DAYTON, OHIO—Bids will be received by the Constructing Quartermaster, Wright Field, Dayton, until June 28, for power transformers for an outdoor substation, to be used for variable load for propeller test, power plant and wind tunnel laboratories.

HAMILTON, OHIO—The City Council has approved the installation of an orna-

mental lighting system on South Second Street from Central Avenue to Notre Dame Academy, to cost about $7,400.

LOGAN, OHIO.—A movement has been started by local business men for the establishment of ornamental lighting system on Main Street. Street-lighting service is supplied by the Ohio Power Company, Canton.

LOGANSPORT, IND.—The Wabash Hydro-Electric Company, care of John A. Schafer, Indianapolis, Ind., consulting engineer, has applied for a permit for a hydro-electric power development on the Wabash River, near Logansport, to cost approximately $500,000.

CHICAGO, ILL.—Plans have been filed by the Commonwealth Edison Company for a substation at 3426 North California Avenue, to cost about $25,000.

DIXON, ILL.—The Illinois Power & Light Corporation has petitioned for permission to erect a transmission line between Mount Zion and Dallas City.

BARABOO, WIS.—Improvements are contemplated by the Wisconsin Power & Light Company, Madison, to its local system, to cost about $40,000. The work will include a new substation and new transformers.

BERLIN, WIS.—Plans are being prepared by the Wisconsin Power & Light Company, Madison, for the construction of a new local power plant, to cost about $40,000. Bolch & Lippert, Gay Building, Madison, are engineers.

GREEN BAY, WIS.—Plans are being considered by the Wisconsin Public Service Corporation for transmission line extensions between Francis Creek and Branch, another out of Manitowoc to Sogge's Corners, and a third extension in the vicinity of Kellnersville.

MILWAUKEE, WIS.—The City Council is considering a proposal providing for the illumination of hundreds of arterial highway stop signs in use throughout the city.

REEDSBURG, WIS. — The Wisconsin Power & Light Company, Madison, plans to build a new substation here and install new transformers.

BELLFLOWER, MO.—The proposal to authorize the East Missouri Power & Light Company, Troy, to establish and operate an electric lighting system has been approved by the voters.

CLAYTON, MO.—The Board of Public Works has submitted to the Board of Aldermen a request for bond issues totaling $186,450 to complete extensions and improvements to the water and lighting systems.

LEIGE, MO.—The voters have approved the proposal to authorize the East Missouri Power & Light Company, Troy, to install and operate an electric lighting system in Leige.

SULLIVAN, MO. — Surveys are being made by the Missouri Electric Power Company, Marshfield, for a transmission line from Sullivan to Cuba, to furnish electric service there.

FAIRMOUNT, N. D.—The State Railroad Board has approved the petition of the Montana-Dakota Power Company for the erection of a transmission line from Kenmare to Mohall.

HAMILTON, N. D.—The State Railroad Board has approved of the sale of the local electric power property to the Otter Tail Power Company, Fergus Falls, Minn.

CRETE, NEB.—The Mayor is advocating a bond issue for the purpose of building a municipal electric generating plant. The Crete Flouring Milling Company, which has furnished energy for the municipal system for a number of years, has asked to be relieved of the burden.

HOLBROOK, NEB.—Plans are under way by the United Rural Light & Power Company, Arapahoe, to erect a transmission line to furnish electricity in Holbrook. The company proposes to supply service to farmers along the proposed line.

Southern States

HIGHLANDS, N. C.—The Federal Power Commission has granted the town of Highlands a permit for a proposed power development on the Cullasagee River. The project will include a small concrete dam, water conduit, surge tank and power house.

LENOIR, N. C.—Application has been made by A. A. Shuford and F. M. Laxton to the Federal Power Commission for a permit for a 2,640-hp. hydro-electric development on Wilson Creek within Boone National Forest. The project will include an arch dam, 80 ft. high, steel penstock extending from dam to power house.

BADHAM, S. C.—The Dorchester Lumber Company is considering the purchase of a steam turbine and other power equipment for a power plant in its proposed local mill.

ATLANTA, GA.—Plans for the proposed local factory to be erected by the High Point Bending & Chair Company, Silver City, N. C., to cost about $100,000, include a power plant, and the installation of electrically-operated machinery.

DAWSON, GA.—Negotiations have been closed whereby the South Georgia Power Company, Albany, will take over the municipal electric plant and distributing system. The company plans to erect a transmission line to furnish hydro-electric service here.

McDONOUGH, GA.—The Georgia Railway & Power Company, Atlanta, which has purchased the electric distribution systems in McDonough and in Locust Grove, plans to erect a high-tension transmission to both towns.

CORAL GABLES, FLA.—Plans for the proposed brick manufacturing plant to be erected by Ray Heald and associates include a power plant. The cost of the building is estimated at $85,000.

HIALEAH, FLA. — The Florida East Coast Railway Company, St. Augustine, plans to build a power plant in connection with its new local freight yards and engine terminal.

INVERNESS, FLA.—The Florida Power & Light Company, Miami, which has acquired the local electric plant, has been granted a franchise by the City Council.

JACKSONVILLE, FLA.—A petition is being circulated among the residents along the Lake City Road for the installation of ornamental lamps along the road from Jacksonville to the county limits, to be presented to the County Commissioners.

LAKELAND, FLA.—The City Council is considering issuing $30,000 in bonds for extensions to the fire-alarm system.

NEW SMYRNA, FLA.—The installation of ornamental lamps on Canal Street, covering a distance of 3 miles, is under consideration by the City Commissioners.

ORLANDO, FLA.—Bonds to the amount of $70,000 have been voted for the installation of a police and fire-alarm system.

CHATTANOOGA, TENN.—The Southern Cities Power Company plans to erect transmission lines in different parts of Roane and Rhea Counties, where franchises have been secured.

HARRIMAN, TENN. — The Tennessee Electric Power Company, Chattanooga, which recently acquired the municipal lighting plant, plans extensions in its transmission lines in this section.

BESSEMER, ALA.—The Southern Bell Telephone Company is considering the installation of underground conduit lines in the downtown district, to cost about $57,000.

THOMASVILLE, ALA.—The Alabama Power Company, Birmingham, which acquired the local electric plant, plans extensions in its transmission lines in this section.

COLUMBIA, MISS. — The Mississippi Power Company, Gulfport, plans to rebuild its local electric power station, recently damaged by fire with loss of about $20,000.

TEXARKANA, ARK.—The City Council is considering the installation of an ornamental lighting system in the downtown district.

CANUTE, OKLA. — The Southwestern Light & Power Company, Lawton, has applied to the Council for a franchise to supply electricity here. If granted the company will extend its 33,000-volt transmission line to Elk City.

BRONTE, TEX.—The West Texas Utilities Company, Abilene, is planning to erect a transmission line from Winters to Bronte to furnish service here.

EDINBURG, TEX.—The municipal electric light and water plant has been acquired by the Valley Electric Company, San Benito. The new owners contemplates improvements to the systems.

FARMERSVILLE, TEX.—The property of the Farmersville Mill & Light Company has been purchased by the Texas & Louisiana Power Company, Fort Worth.

MARTINDALE, TEX.—The Texas Public Utilities Company, Dallas, is planning to rebuild the distribution system and transmission lines in Martindale, Maxwell and Staples.

ODEM, TEX.—The installation of an electric light and water plant, to cost about $18,000, is under consideration. L. Garret is interested in the project.

Pacific and Mountain States

BELLINGHAM, WASH.—Permission has been granted the Mount Baker Development Company, to use water from Bagley Creek for a proposed hydro-electric development, to cost about $65,000.

BELLINGHAM, WASH. — The North Electric Power & Light Company, Inc., recently organized, care of Hadley & Abbott, Mason Building, Bellingham, contemplates the erection of a transmission line for service in nearby rural sections.

ELLENSBURG, WASH. — The Puget Sound Power & Light Company, Seattle, is erecting a 33,000-volt transmission line to parallel the irrigation canal down the west bank of the Yakima River, to serve the ranches in that territory. The line will connect with the new substation to be erected in Ellensburgh.

FRESNO, CAL. — The San Joaquin Light & Power Corporation, has secured a license to use waters from the North Forks of the Kings River, Rancheria and Statum Creeks, Fresno County, for a proposed hydroelectric power development to aggregate 7,100 hp., to cost about $3,500,000.

LOS ANGELES, CAL.—The Board of County Supervisors has authorized the installation of ornamental lamps on the Kings Road, from the Santa Monica Boulevard to the city limits and on Stanley Avenue, using concrete standards.

LOS ANGELES, CAL.—The Denby Motor Truck Company of California, operated by the Denby Motor Truck Company, Detroit, will install electric power equipment in its proposed local manufacturing plant, to cost about $200,000.

MARYSVILLE, CAL. — The Northern California Canning Peach Growers' Association, recently organized, plans to build a power plant in connection with a proposed canning factory in the Sacramento Valley district. The cost of the project is estimated at $2,000,000. James M. Cremin, 800 G. Street, is president.

OJAI, CAL.—Plans are being prepared by the Ojai Irrigation District for the construction of a hydroelectric power plant in connection with an irrigation project. The initial installation will have an output of 6,800 hp., and will cost about $310,000, including penstock and transmission lines. Guy T. Stetson is trustee. J. B. Lippincott, Los Angeles, is engineer.

UPLAND, CAL.—Bids will be received by E. C. Mehl, city clerk, until July 1, for the installation of ornamental lamps on Second Avenue and on Ninth Street.

GREAT FALLS, MONT.—Plans are being prepared by the Montana Power Company, Butte, for a power dam in connection with the addition to its hydroelectric plant, to cost about $300,000. Charles T. Main, 200 Devonshire Street, Boston, is consulting engineer.

SHERIDAN, WYO.—Plans are under way by the Chicago, Burlington & Quincy Railroad Company, Chicago, for the construction of a local steam-driven electric power plant.

BRIGHTON, COL.—The Public Service Company of Colorado, Denver, plans to build of a local substation, and also extensions and improvements in transmission lines.

HOTCHKISS, COL.—Charles S. Shryock, Hitchkiss, and associates have applied for a franchise to build an electric power plant for local commercial service.

McGREGOR, COL.—Plans have been prepared by the Colorado Utilities Corporation, Steamboat Springs, for a local steam-operated electric power plant to cost about $45,000.

Canada

CALGARY, ALTA.—An extension to No. 1 substation of the city power system on Ninth Avenue West, to cost about $28,000, has been approved by the City Commissioners, and will be submitted to the City Council.

QUEBEC, QUE.—Preparations are being made by the Mistassini Pulp & Power Company, recently organized, for a power development on the Mistassini River and the construction of a pulp and paper mill with a capacity of over 200 tons per day. A. E. Wallberg, Toronto, heads the Mistassini company and John Stadler is general manager.

Electrical Patents

Announced by U. S. Patent Office

(Issued May 25, 1926)

1,586,172. CIGAR LIGHTER; C. Baia, Pallsade, N. J., and A. Aderente, Jersey City, N. J. App. filed May 14, 1924.

1,586,182. TELLTALE FOR TANKS; G. E. Deathrage, Detroit, Mich. App. filed April 23, 1925. Means for sealing an electrical signaling mechanism against the entrance of gases from the combustible liquids or the combustible liquid itself.

1,586,215. STORAGE-BATTERY CLOSURE AND METHOD OF FORMING THE SAME; W. Petschel, Owatonna, Minn. App. filed March 31, 1923.

1,586,231. ALTERNATING-CURRENT MOTOR; H. Weichsel, St. Louis, Mo. App. filed May 21, 1924. Method of starting an alternating-current motor of the self-excited synchronous type. To eliminate polyphase currents from the commutator at starting and thus avoid commutation difficulties which these may cause and to reduce the resistance of the secondary starting circuits to the lowest possible value whereby a maximum induction-motor speed (minimum slip) may be attained by the machine prior to making the connections whereby the machine may be caused to operate as a synchronous motor.

1,586,233. MEANS FOR CONTROLLING ROTATING FIELD MOTORS; H. Anschutz-Kæmpfe, Munich, Germany. App. filed March 19, 1925. By slight variations in resistance inductance or capacity, the direction of rotation and the speed of the motor is varied.

1,586,240. RESISTOR GRID; F. T. Cope, Salem, Ohio. App. filed Dec. 21, 1925. Of serpentine shape, having connecting webs or shunts between certain loops for normally lowering the resistance, said webs being adapted to be severed or removed to increase the resistance of the grid.

1,586,333. ELECTRICAL SWITCHING SYSTEM; W. M. Scott, Tredyffrin Township, Chester County, Pa. App. filed March 28, 1922. Comprising switching or circuit-breaker mechanism forming a connection between a source of current and a consumption circuit or translating device, the switching or circuit-breaker mechanism providing protection against underload or reversed current, overload or excess current, no voltage, and reversal of polarity or voltage.

1,586,341. ELECTRIC SIGNAL APPARATUS; F. S. Tucker, Boston, Mass. App. filed May 25, 1921. Call system.

1,586,348. SECTIONAL INSULATOR; H. W. Allen, Cleveland, Ohio. App. filed March 30, 1921. Formed of sections that preferably are symmetrical, which are adapted to be locked in place by a suitable keying member, to wit, the inserted electrical conductor or conductors.

1,586,367. ELECTRIC LAMP SOCKET; F. E. Johnson, New Bedford, Mass. App. filed Aug. 4, 1925.

1,586,406. PROCESS FOR THE INSULATION OF ACCUMULATOR PLATES OF DIFFERENT POLARITIES; L. Caillard, Levallois-Perret, France. App. filed June 8, 1924. Consists in entirely enclosing each positive accumulator plate, for example, in a protecting compartment, which can be easily traversed by the electric ions and the resistance of whose walls is sufficient to maintain the active material which may become detached from the positive plate, thereby preventing it from falling to the bottom of the vessel.

1,586,435. ELECTROLYTIC TANK; L. Arnalot, Barcelona, Spain. App. filed Dec. 5, 1923. In combination with a refrigerator adapted to limit the rise in temperature of the electrolyte, preventing the further decomposition of certain electrolytes.

1,586,436. ELECTRIC SIGN; F. Z. Barrundia, Mexico, Mex. App. filed Aug. 25, 1923. Moving electric display of advertising signs.

1,586,438. TERMINAL-BLOCK ATTACHMENT; R. R. Beezley, Memphis, Tenn. App. filed May 27, 1924. For storage batteries.

1,586,503. DOOR-OPERATED SWITCH; E. Williard and A. Williard, Pawnee, Okla. App. filed June 14, 1924. For indicating at a remote point the presence of mail in a mail box.

(Issued June 1, 1926)

1,586,533. THERMIONIC METER; E. Peterson, New York, N. Y. App. filed April 27, 1922. For measuring the power consumed by a circuit carrying an alternating current and particularly currents of high frequency.

1,586,549. ALTERNATING-CURRENT RELAY; J. R. Fry, New York, N. Y. App. filed May 11, 1922. Responds with certainty to currents of a desired frequency even though such currents be very feeble, but does not respond to a periodic current or currents of other frequencies.

1,586,550. ELECTROMAGNETIC APPARATUS; G. Fussner, Menominee, Mich. App. filed Nov. 18, 1921. Relays for transmitting a signal concurrently to a plurality of stations.

1,586,569. REGULATOR; P. A. Newman, Woodhaven, N. Y. App. filed May 19, 1922. Responds to an abnormal condition of the system with which it is associated to restore this system to a predetermined condition with the least possible disturbance to the system. Designed to prevent hunting or overthrow of regulation in a regulator; preferably for voltage. For use with a dynamo having a high time constant. This object is accomplished by regulating at the source the voltage generated in such a manner that when it is abnormal in either sense the regulation is intermittently applied to prevent hunting.

1,586,585. WELDING MACHINE; A. M. Stanley, Lynn, Mass., and J. E. Sims, Quincy, Mass. App. filed Nov. 25, 1921. For welded-steel vehicle wheels.

1,586,588. CHARGING HOPPER FOR ELECTRIC FURNACES; C. T. Thorssell, E. C. Beck-Friis and E. E. Eslundh, Gothenburg, Sweden. App. filed June 20, 1921. To eliminate the disadvantages incident to the collecting of the escaping gases.

1,586,589. LIQUID-FUEL GAGE; J. W. Walker, Topeka, Kan. App. filed Feb. 12, 1925. For use in connection with tanks.

1,586,642. INSULATOR PIN; J. P. Arndt, South Milwaukee, Wis. App. filed Dec. 31, 1920. Made of metal stampings. For attachment to the cross-arm of a line conductor pole which may be arranged in different positions on the cross-arm and can be used on cross-arms of different sizes.

1,586,643. AMPERE-HOUR METER; G. F. Bason, Ithaca, N. Y. App. filed Nov. 28, 1923. Comprising a rotary element and current-responsive means tending to cause the element to rotate in direct proportion to the amperes of an alternating-current circuit; having a substantially straight-line operation characteristic.

1,586,649. ELECTRICAL MEASURING INSTRUMENT; J. E. Bridges, Alameda, Cal. App. filed May 15, 1924. To indicate the periodic demand of the energy consumed in a circuit, under certain operating conditions, and be automatically rendered inoperative to give no indication of the demand during other operating conditions. An off-peak demand meter.

1,586,650. ELECTRICAL SWITCH; A. J. Briggs, Syracuse, N. Y. App. filed May 20, 1922. Three position; adaptable to a flashlight.

1,586,652. MAKE-AND-BREAK DEVICE; J. H. Cannon, Los Angeles, Cal. App. filed June 9, 1924. An automatic interrupter or control device suitable for use in connection with flashing signs or like loads.

1,586,669. ELECTRIC SWITCH; F. P. Gates, West Hartford, Conn. App. filed April 22, 1922. Reciprocating type having a rotary handle.

1,586,682. SWITCH CONTACT MEMBER; W. E. McCoy, New York, N. Y. App. filed April 23, 1920. A knife-blade or similar switch structure in which the jaw or co-operating receiving members shall be so universally movable and resiliently mounted with respect to the base portion of the jaw structure as to be readily adapted for effective engagement with the knife-blade or other co-operating member, irrespective of certain irregularities in the form and position of the latter.

1,586,690. WELDING ARTICLES OF VARYING THICKNESS; T. E. Murray, Jr., Brooklyn, N. Y. App. filed Feb. 1, 1923. To secure a uniform effect, particularly in the electric butt welding of tubular segments which are thicker at one point of their length than at another.

1,586,691. WELDING; T. E. Murray, Jr., Brooklyn, N. Y. App. filed Feb. 8, 1923. Process of welding materials which are of different thicknesses at different points in the joint.

1,586,696. ELECTRICAL MEASURING INSTRUMENT; R. T. Pierce, Swissvale, Pa. App. filed Jan. 3, 1920. Frequency meter.

1,586,709. ELECTRIC FIXTURE COUPLING; A. I. Schwinger, Philadelphia, Pa. App. filed July 8, 1922. Permits of conveniently wiring fixtures before mounting the same in a building.

1,586,711. RELAY SYSTEM FOR CONTROLLING INTERPOLE EXCITATION OF ROTARY CONVERTERS; E. B. Shand, Pittsburgh, Pa. App. filed Oct. 16, 1922. Type of control apparatus in which a controlling force is balanced against a force proportional to the controlled quantity, the last-mentioned force being derived by means of a spring carried by a movable support which is adjusted in position in accordance with the adjustment of the controlled apparatus.

1,586,713. ATTACHMENT PLUG FOR ELECTRIC IRONS; E. Sjolin, Chicago, Ill. App. filed July 30, 1921.

1,586,714. CREST VOLTMETER; J. Slepian, Swissvale, Pa. App. filed Dec. 13, 1920. Direct-reading instrument.

1,586,744. METHOD OF REVERSING POLARITY OF SYNCHRONOUS CONVERTERS; A. D. Howry, Lancaster, Pa. App. filed Aug. 12, 1922. System whereby a predetermined polarity may be automatically developed in a self-starting synchronous converter.

1,586,855. POLARIZED RELAY; M. B. Stazak, Chicago, Ill. App. filed Jan. 26, 1921. The space on air gap between the armature and the ends of the magnet cores can be readily adjusted.

1,586,875. CONTINUOUSLY LOADED SUBMARINE CABLE; O. E. Buckley, Maplewood, N. J. App. filed Aug. 16, 1921. Such that the characteristics of the loading material will be retained after submergence in considerable depths of water.

1,586,877. ELECTROMAGNETIC DEVICE; O. E. Buckley, Maplewood, N. J. App. filed April 4, 1924. To decrease the hysteresis loss and to maintain high permeability in certain magnetic alloys in which high permeability may be developed.

1,586,885. ELECTROMAGNETIC DEVICE; G. W. Elmen, Leonia, N. J. App. filed Aug. 16, 1921. Static frequency changer. Frequency multipliers or harmonic producers of the type in which cyclically varying, flux-inducing secondary currents contain components which are harmonics of the inducing current.

1,586,889. MAGNETIC STRUCTURE AND METHOD OF MANUFACTURE; G. W. Elmen, Leonia, N. J. App. filed March 17, 1924. To overcome or greatly reduce disadvantages in magnetic structures employing material which is sensitive to strain.

1,586,953. SWITCH MECHANISM; L. F. Meunier, Cleveland, Ohio. App. filed July 30, 1924. Locking mechanism controlled by one control device for temporarily rendering a second control device inoperative.

1,586,958. PULL-SWITCH SOCKET; R. B. Benjamin, Chicago, Ill., and C. E. Warner, Berwyn, Ill. App. filed Sept. 27, 1920.

1,586,993. ELECTRIC SWITCH; H. A. Hoeschen, Omaha, Neb. App. filed Nov. 25, 1924. Wherein a circuit is closed and opened by a movable body of conductive fluid operating in a semi-spherical curvilinear double-wall tube formed from insulating material, preferably glass or enamel-lined material, which is non-conductive.

1,587,010. GALVANOMETER; W. R. Coley, Philadelphia, Pa. App. filed March 20, 1924. The type having a moving system comprising a coil deflecting or rotatable in a magnetic field.

1,587,032. COVER FOR ELECTRIC CONDUIT OUTLET BOXES; J. T. Pearson and R. H. Olley, Syracuse, N. Y. App. filed April 17, 1922.

1,587,047. SECONDARY ELECTRIC CLOCK; E. G. Stalnaker, Chicago, Ill. App. filed Nov. 5, 1924.

1,587,050. ELECTRICAL INDICATOR; H. L. Tanner, Brooklyn, N. Y. App. filed April 13, 1922. For the measuring of resistance.

1,587,061. AUTOMATIC ELECTRIC CONTROLLING DEVICE; C. R. Anderson, Dallas, Texas. App. filed Aug. 28, 1922. A device which may either be used as a controlling means in the recharging of batteries or as an automatic starting and stopping device for the charging circuit of farm-lighting plants and the like.

1,587,118. LATH SUPPORT FOR ELECTRIC FIXTURE UNITS; L. R. Greusel and C. W. Finley, Battle Creek, Mich. App. filed May 20, 1925.

1,587,121. REMOTE CONTROL AND SUPERVISORY SYSTEM; J. B. Harlow, Upper Montclair, N. J. App. filed Dec. 1, 1921.

1,587,122. ELECTRICAL SWITCHING AND INDICATING SYSTEM; J. B. Harlow, Upper Montclair, N. J. App. filed Dec. 31, 1921. Remote control and supervisory method.

1,587,138. ELECTRICAL CONNECTOR DEVICE; R. B. Benjamin, Chicago, Ill. App. filed Sept. 19, 1921. Two-way plug.

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Contents of This Issue

Editorials 1383

Putting Up a Front 1383
How Shall New Business Be Defined? 1383
Exchanging New Ideas Is the Basis of Progress. 1383
N.F.P.A. on Trial as Sponsor of the Code 1384
Transmission-Line Stability an Economic Problem 1384
Convention of Association of Iron and Steel Electrical Engineers 1385
Behind the Scenes in Interconnection 1385

Frontispiece—Laying a New 4,000-Mile Transatlantic Cable 1386

Annual A.I.E.E. Convention 1387

Technical papers, discussions and committee reports cover the theory of synchronous machines, non-harmonious alternating currents, a.c. circuits, dielectric break-down, rectifiers, magnetization, heat transfer in machines, auto transformers, electrical measurement of mechanical vibration, remotely controlled substations, high-speed circuit breakers, regenerative braking and windings for d.c. machines.

Group-Operated Disconnecting Switches 1394

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Heating Pitch Electrically 1397

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The Meterman and His Responsibilities . 1399

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Letters from Our Readers 1400

Central Station and Industrial Practice . 1402

Cascade Control for Street Lights 1402
Insulator Testing Machine 1402
Keeping Distribution Maps Up to Date 1403
Motorcycle Cart for Cable Splicing 1404
Rotation Indicator Made from Wattmeter Parts. 1405

Commercial Activities and Public Relations 1406

Electric Refrigerator Practices at Rockford 1406
Advantages of Electric Tractors in Industry ... 1406
Courtesy Card Aids Customers in Establishing Credit 1407
Energy Consumption of Rural Customers 1407
Boston Industrial Heating Load Shows Rapid Gain 1408

Digest of Electrical Literature 1409

News of the Industry 1411

Men of the Industry 1418

Court Decisions, Commission Rulings ... 1420

Financial and Corporate 1421

Manufacturing and Markets 1425

Business Conditions 1426

Activities of the Trade 1428

New Equipment Available 1429

Construction News 1430

Electrical Patents 1432

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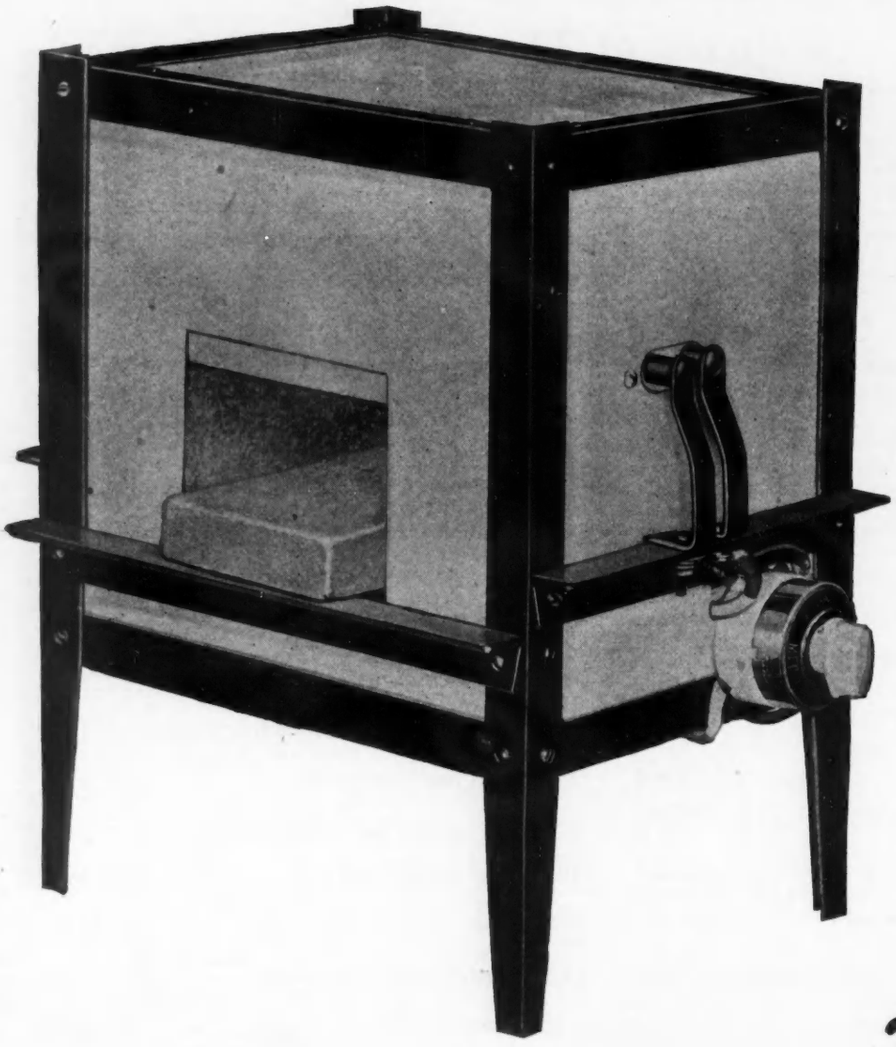
Advertising Index—Alphabetical, 82; Classified, 76, 78, 80; Directory of Engineers, 38, 39; Searchlight Section, 40-47

Globar



Non-Metallic

Electric Heating Element

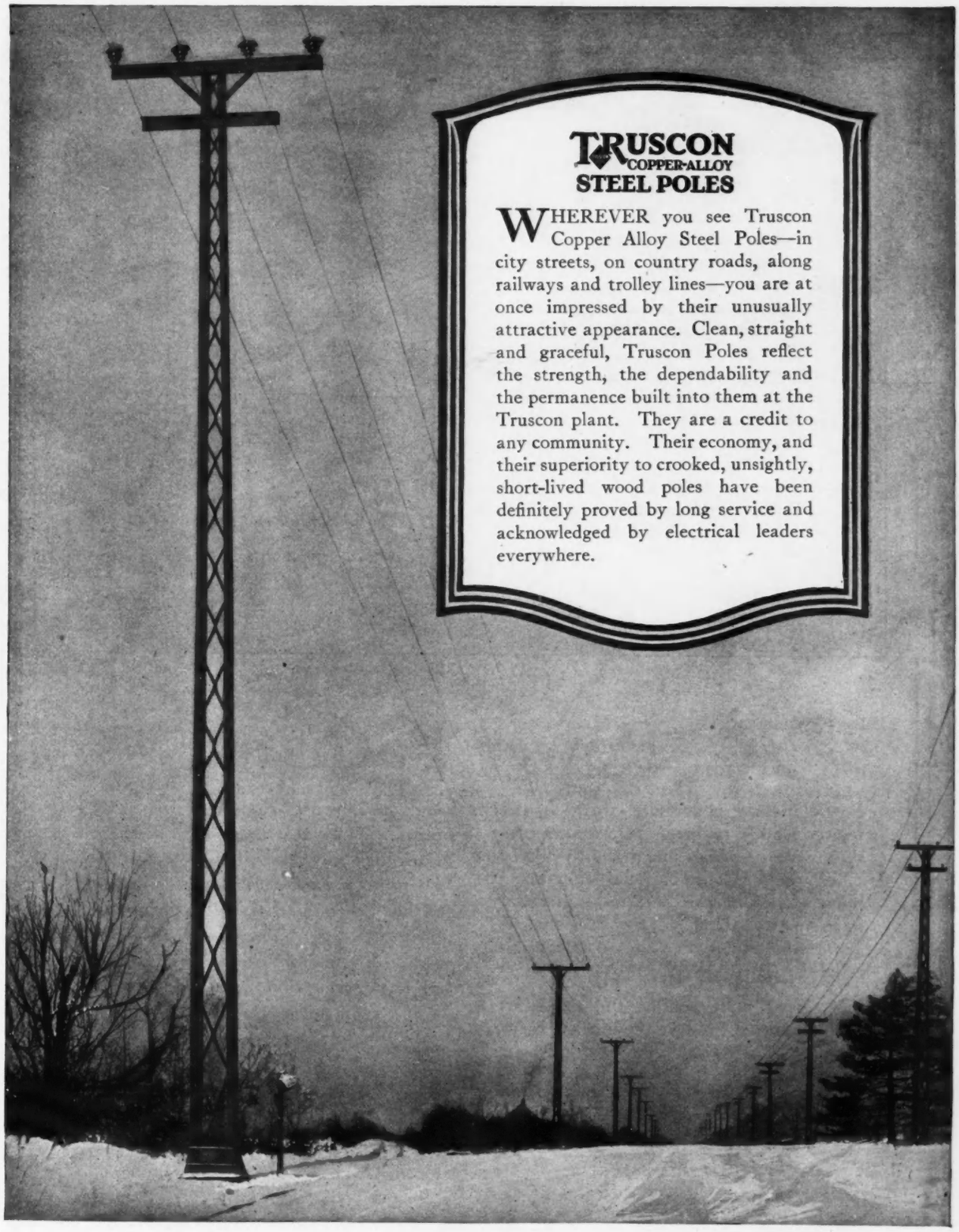
Cartridge Type

Globar heating elements can be mounted at any angle, to meet any operating condition, with assurance of highly satisfactory performance. The life of Globar Elements reduce replacements to the point of real economy. Globar Elements have a working temperature range up to 2750° F.

American Resistor Corporation
Milwaukee, Wis.

NEW YORK CHICAGO PHILADELPHIA CLEVELAND
LOS ANGELES SAN FRANCISCO

The **Element of Economy**


TRUSCON
COPPER-ALLOY
STEEL POLES
WHEREVER you see Truscon Copper Alloy Steel Poles—in city streets, on country roads, along railways and trolley lines—you are at once impressed by their unusually attractive appearance. Clean, straight and graceful, Truscon Poles reflect the strength, the dependability and the permanence built into them at the Truscon plant. They are a credit to any community. Their economy, and their superiority to crooked, unsightly, short-lived wood poles have been definitely proved by long service and acknowledged by electrical leaders everywhere.

TRUSCON STEEL COMPANY, Youngstown, Ohio

Warehouses and Offices in all Principal Cities.
Railroad Dept.: 165 E. Erie St., Chicago, Ill.
Foreign Trade Division, New York.
The Truscon Laboratories, Detroit, Mich.
Trussed Concrete Steel Co. of Canada, Ltd., Walkerville, Ont.

Power Paths

Power passes peacefully through the winter woods to bring to workers productiveness by day and light by night. These arteries of national life bring more wealth in work and more pleasure in leisure for us all. They are efficient and reliable in proportion to insulation reliability.

The great disturber of the peace of power paths is lightning—and the lightning season is coming on. Jeffery-Dewitt Insulators of thick porcelain resist flashover and resist shattering when it occurs. They are tunnel-kiln fired for uniformity and cementless for long life. When he adopts this rugged product for his power paths the engineer has nothing to fear. The line is protected from the common causes of insulator failure, interruption, and depreciation.

Some able men responsible for many thousands of miles of power paths are buying insulators by Jeffery-Dewitt.

Jeffery-Dewitt Insulator Company

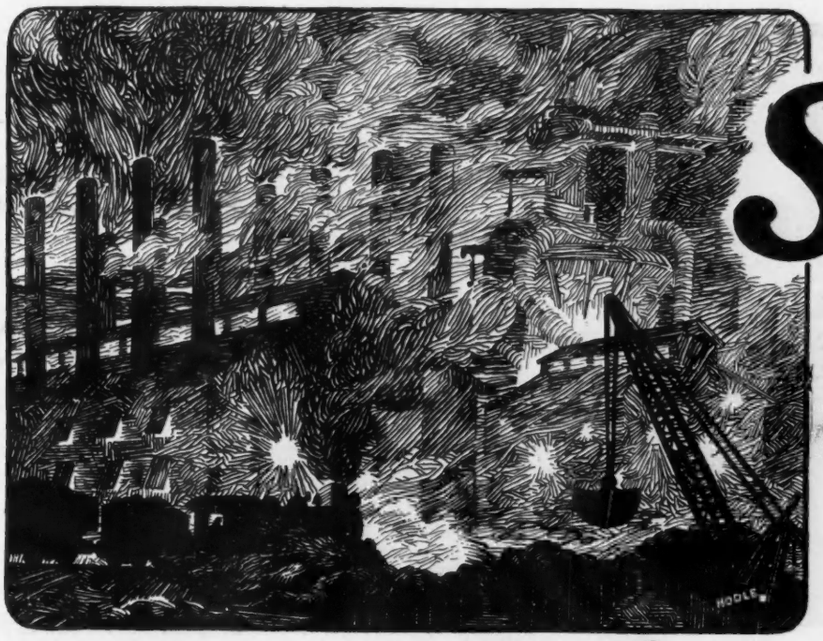
Kenova, W. Va., U. S. A.

Foreign Agents
Montreal, Canada, Sydney, Australia, Wellington, N. Z., Bombay, India, Tokio, Japan, Paris, France, Milan, Italy.

District Offices
New York, 2 Rector St.
Chicago, 924 Marquette Bldg.
Atlanta, 413 Glenn Bldg.

Agents in U. S. A.
Los Angeles, San Francisco, Seattle, Spokane, Salt Lake City, Denver, Kansas City, St. Paul, Detroit, St. Louis, Indianapolis, Dallas.

JEFFERY-DEWITT INSULATOR CO. KENOVA, W.VA. U.S.A.



Steel

TOWERS
POLES
SUB—STATIONS

and other steel products for utilities

Confidence!

Because of our experienced personnel, because of our engineering and production resources, and because of our location here in Gary, famed for its production of steel and its steel men, you can depend on us with the utmost confidence.

In our engineering department we have one of the seven famous tower designers and structural steel engineers from the eastern district together with tower engineers from our own territory.

Our Production Department is headed by a former production manager with the largest steel fabricating company in the world.

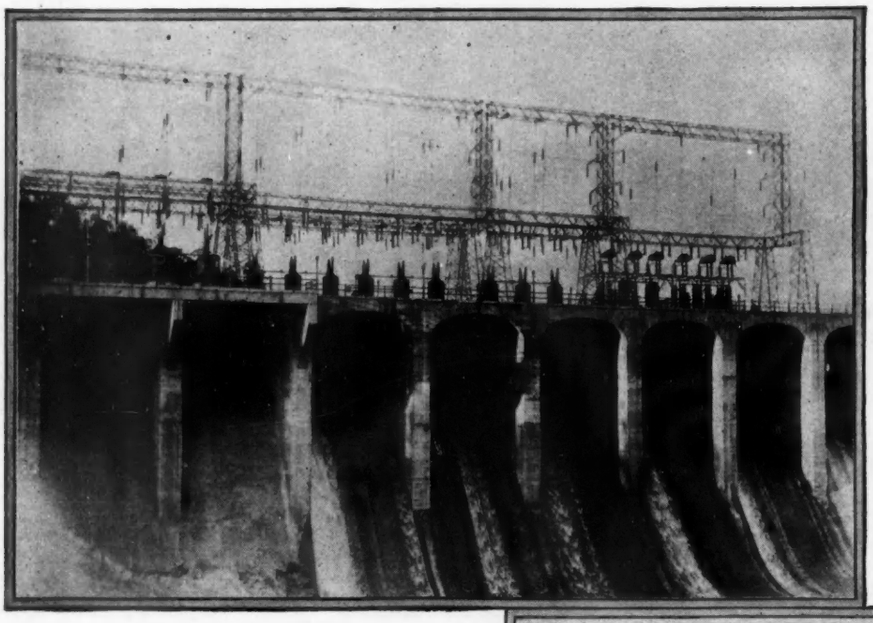
Specially designed automatic and accurate machinery, electrically operated is the positive assurance of a high grade product.

Steel structures painted or galvanized, with or without erection.

Everything in Steel Supporting Structures

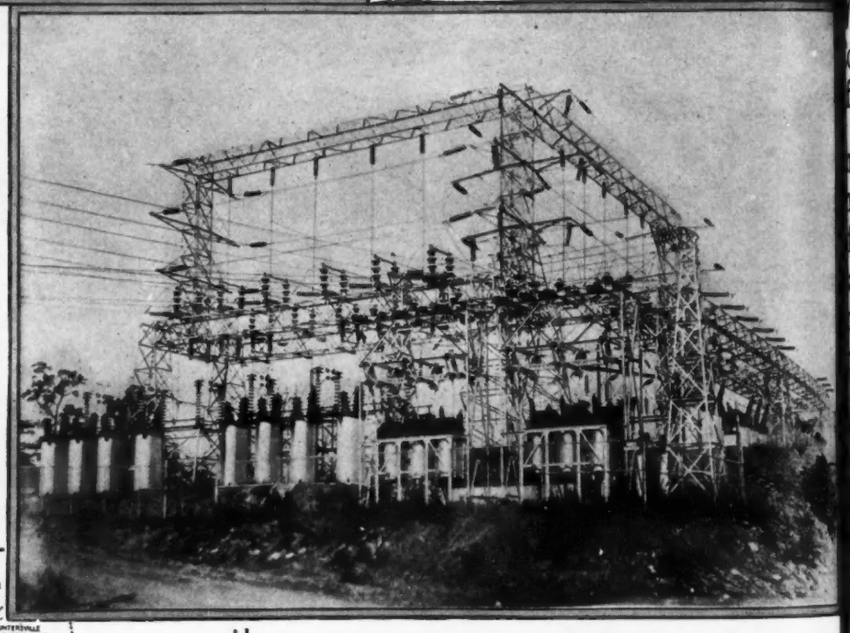
WALTER BATES STEEL CORPORATION

GARY INDIANA.



West end of Mitchell Dam with 110,000-volt switching station.

Alabama Po
Serves th
and vi



Outdoor substation, near Clanton. 110,000-44,000 volts.

BIRMINGHAM

...ower Co.

...he South

...with O-B Insulators

WITH over 3000 miles of transmission and distribution lines, Alabama Power ...mpany service extends over the State ...f Alabama.

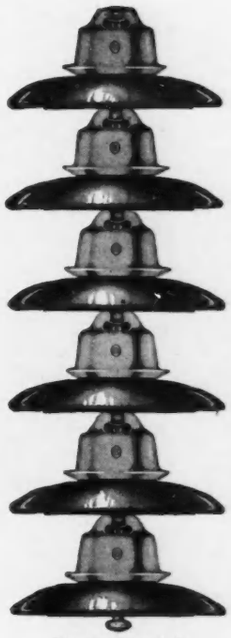
...n anticipating growth of power require...ents and in maintaining a high record ...f uninterrupted power service, this com...any has assisted the cotton, coal and iron ...dustries of this territory in their rapid ...rowth.

...nterconnection with five other prominent ...wer companies guarantees capacity in power ...d further safeguards the power users against ...stly interruptions, not only on Alabama Power ...mpany lines, but on the lines of the intercon...ected companies as well.

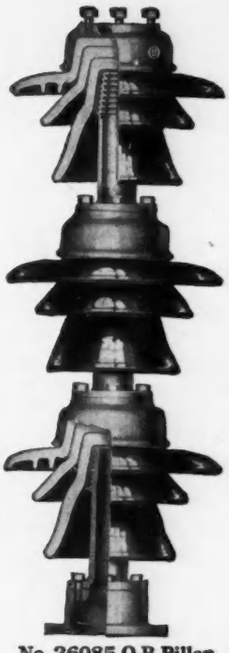
...ere is a public utility development fully meeting ...e industrial and community needs for electric ...ower.

...nd here are O-B Insulators meeting the demand ...r continuous operation and low annual cost ...hrough long life.

Ohio Brass Company, Mansfield, Ohio
Dominion Insulator & Mfg. Co., Limited
Niagara Falls, Canada
109H



No. 25620 O-B Suspension Units
With the efficient and convenient ball and socket connection.



No. 26085 O-B Pillar Insulator
Can be built up as desired by bolting together interchangeable units.

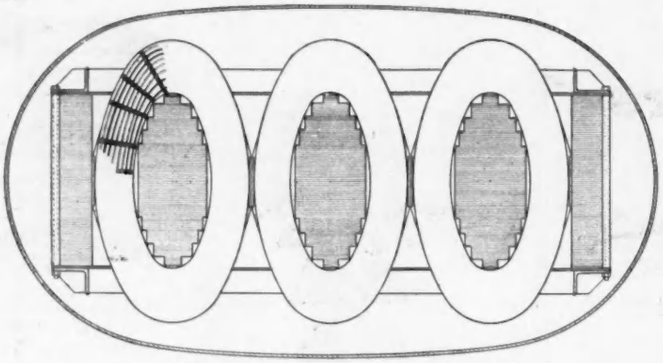
Ohio Brass Co.

PORCELAIN INSULATORS
LINE MATERIALS
RAIL BONDS
CAR EQUIPMENT
MINING MATERIALS
VALVES

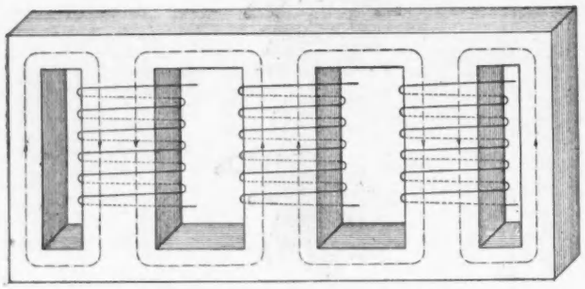
The Advantages of Pittsburgh Polyphase Transformers

MODERN practice in generation is three phase,—
In transmission is three phase,—
Substantially all distribution and motors are three phase.

IN other words, the whole system from power house to mechanical power from the motors is three phase ——— except, in some cases, single phase transformers are used.



Cross Section of Pittsburgh Polyphase Transformer



Pittsburgh Polyphase Magnetic Circuits

WHY should not three phase transformers be always used in this almost 100% three phase system ———instead of single phase transformers?

THE same reasons which apply to the use of three phase generators and three phase motors in place of three single phase generators or three single phase motors apply with equal or greater force to the use of three phase transformers in place of single phase transformers.

THREE phase transformers have the following advantages over three single phase transformers:

1—Lower First Cost (from 5% to 30% lower).
2—Higher Efficiencies.
3—Less Weight.
4—Less Space Occupied.
5—Lower Maintenance Charges.
6—Lower Transportation Charges.
7—Lower Cost for Supporting Structure.
8—Lower Installation Cost.

PITTSBURGH Polyphase Transformers, however, have the following additional advantages over three single phase transformers and also over the ordinary three phase transformers:

9—Balanced electric and magnetic circuits and, therefore, avoids difficulty due to surging when switching.
10—Close Uniformity of Exciting Current between phases,—eliminating switching trouble from this source.
11—Lower Exciting Current.
12—Noiseless Operation.
13—Will Operate Open Delta.

THE Exciting Current per phase is more uniform in Pittsburgh Polyphase Transformers than in three single phase transformers or in the ordinary three phase transformers,— thus resulting in better switching conditions and the reduction of surges when switching.

THE Pittsburgh Polyphase Transformer also embodies the elliptical arched coil construction which has contributed so greatly to uniform and efficient excitation and magnetization.

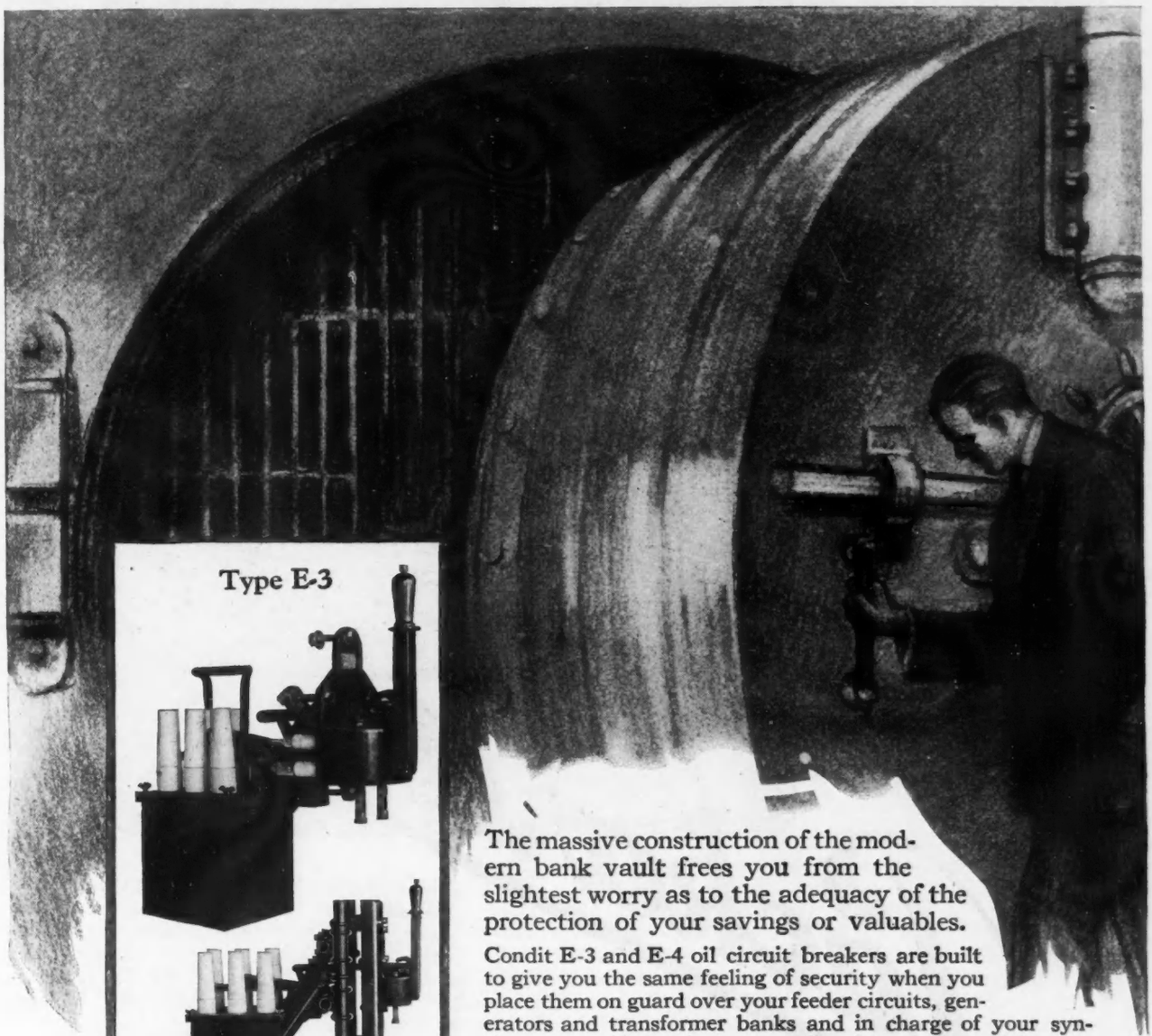
(*See Bulletins* 2035 *and* 2045)

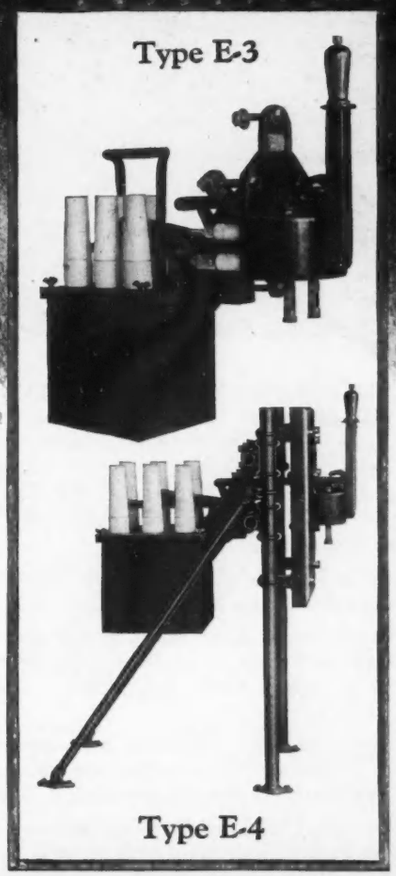
Pittsburgh Transformer Company

Largest Manufacturers of Transformers exclusively in the United States

Pittsburgh, Pennsylvania

PROTECTED





The massive construction of the modern bank vault frees you from the slightest worry as to the adequacy of the protection of your savings or valuables.

Condit E-3 and E-4 oil circuit breakers are built to give you the same feeling of security when you place them on guard over your feeder circuits, generators and transformer banks and in charge of your synchronous and induction motors. Consistently dependable performance entitles them to your complete confidence.

"*Get in touch with Condit*"

CONDIT ELECTRICAL MFG. CORP.

Manufacturers of Electrical Protective Devices

Boston, Mass.

Northern Electric Company LIMITED

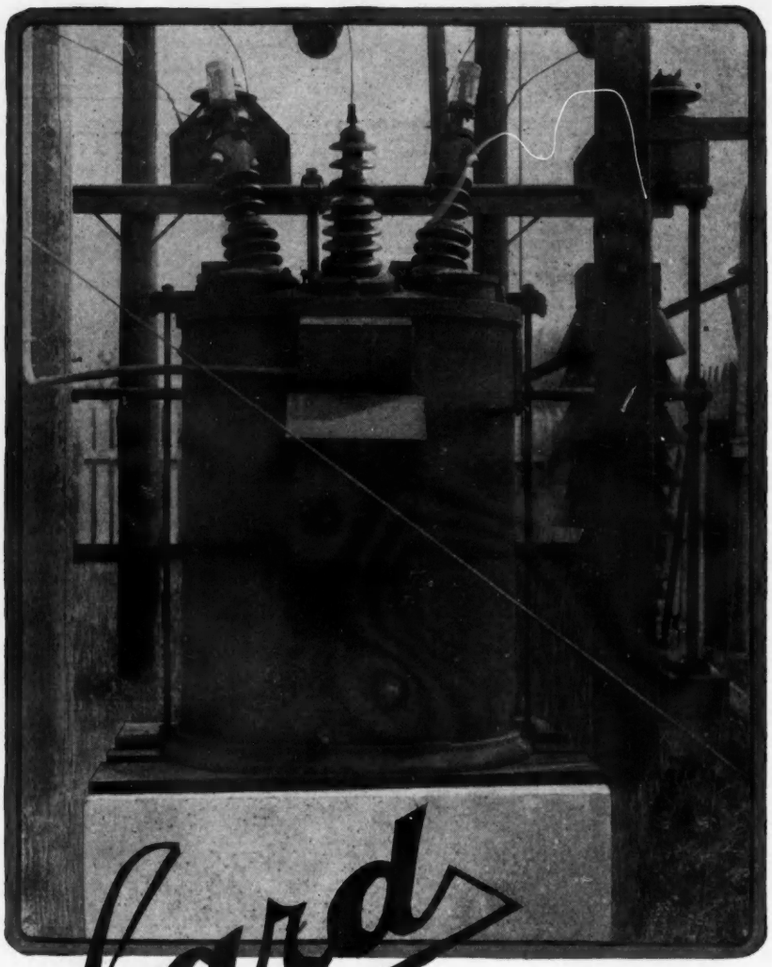
Sole Distributor for the Dominion of Canada

SPECIFICATIONS: Standard Ampere Capacities, Type E-3 at 4500 volts, or less; Type E-4 at 7500 volts, or less. Interrupting Capacity (per phase) Type E-3, 2700 amperes at 2500 volts; Type E-4, 5100 amperes at 2500 volts.

8472

CONDIT

A Big Metering Transformer



Packard

This 44,000 volt, Type P. C. W. Packard Weatherproof Metering Transformer has been giving perfect service since its installation three years ago. It is on the lines of the Des Moines Electric Light Co. at Newton, Iowa, metering primary power to the Iowa Southern Utilities Company at that point.

Both current and potential elements are combined in the one unit, and its accuracy tests very high.

Packard Weatherproof Metering Transformers are compact, accurate, and easy to install. The elements are contained in a rugged steel tank which is filled with transformer oil.

Very moderate cost of installation and operation, low upkeep and freedom from breakdowns, give Packard Metering Transformers distinct economic advantages.

We build a Complete Line of Weatherproof Metering Transformers both in individual type as well as the combined unit type illustrated above. Let us confer with you on your needs.

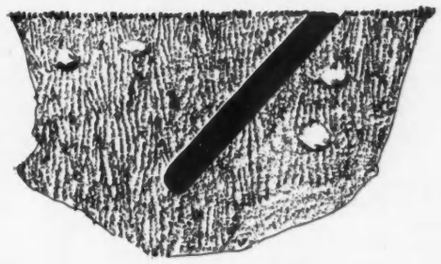
The Packard Electric Co.

Warren, Ohio

Packard is never seen, except on goods of honest value

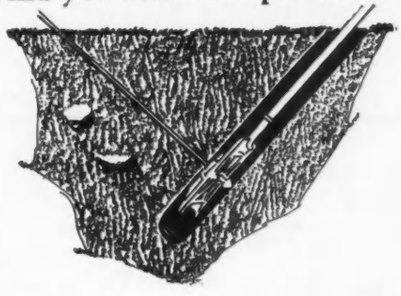
How it's done with the Never-Creep Anchor

You bore a hole like this



And you drive the rod in thus

And you insert the plate so



EFFECTIVE HOLDING POWER

Compare the effective holding power of Never-Creep with any other anchor. Note that Never-Creep is "bolted through solid earth." Figure the number of cubic feet of earth that would have to be displaced in order to pull out a Never-Creep Anchor.

Then do the same for any other anchor and you'll admit that Never-Creep is superior in effective holding power.

But increased holding power is only one of the advantages of Never-Creep Anchor.

Another advantage of Never-Creep Anchors is the saving in labor costs.

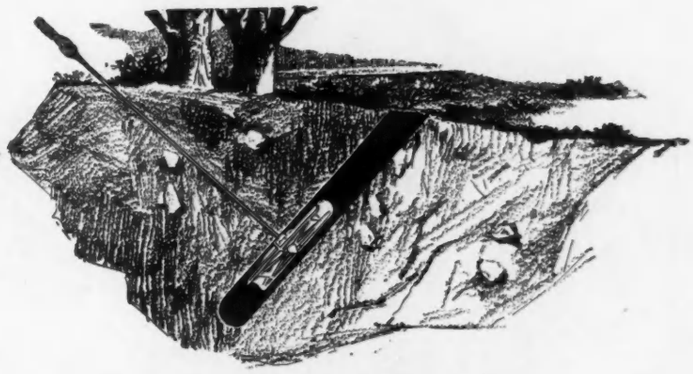
There are no big pits to be dug and filled in again for the installation of Chance Never-Creep Anchors. Costly pick and shovel labor is eliminated. A hole drilled by an 8-inch "Chance Auger" is all that is necessary to install a "Never-Creep."

The iron dead-man on a Chance Never-Creep Anchor makes the installation permanent—no rotted wood to be dug up and replaced. And the Thimble-eye which is the solid head of the Never-Creep Anchor Rod requires no guy thimble as with an ordinary anchor rod. The Thimble-eye Rod is an exclusive Chance feature.

CHANCE CO.

Centralia, Mo.

And you have this →



Effective because

"BOLTED through solid earth"

Q.E.D.

Lightning takes the Quickest Path

If a voltage with a steep wave front is impressed upon a string of insulators, the spark-over path which will be followed is not only a matter of distance but of impulse ratio.

Very often on insulator strings equipped with horns, which might clear a 60 cycle arc, *the path over the porcelain* is faster for a lightning discharge and, consequently, the horns give no protection. A 60 cycle test in this connection, therefore, means nothing.

The damage is done in .04 of a micro-second. Only by careful grading of the insulator string by means of a Locke Grading Shield can this first predatory discharge be kept away from the porcelain.

Tests made with the Lightning Generator Circuit have fully established the need for Grading Shield Equipment on relatively low voltage transmission lines, such as from 33 kv. to 100 kv., if the destructive flashover troubles are to be corrected. The design of such equipment is essentially the same as that furnished on 220 kv. and 132 kv. lines, but of lighter construction.

Write for bulletin on Locke Grading Shield and Arcing Horn Equipment.

Locke Insulator Corporation
Baltimore, Md.
Factories at Victor, N. Y. and Baltimore, Md.

LOCKE
PORCELAIN

SALES OFFICES:

Boston, Mass., 84 State St.; New York, N. Y., 120 Broadway; Victor, N. Y.; Philadelphia, Pa., 803 Atlantic Bldg.; Dallas, Texas, 1801-15 North Larmar St.; Chicago, Ill., 770 Illinois Merchants Bank Bldg.; Atlanta, Ga., 414 Red Rock Bldg.; Salt Lake City, Utah, 310-314 West Second South St.; Denver, Colo., 819 Seventeenth St.; San Francisco, Cal., 575 Mission St.; Los Angeles, Cal., 236 S. Los Angeles St.; Portland, Oregon, 61 Fifth St. North; Seattle, Wash., 570 First Ave. South.

EXPORT AGENTS:
International General Elec. Co., Schenectady, N. Y.

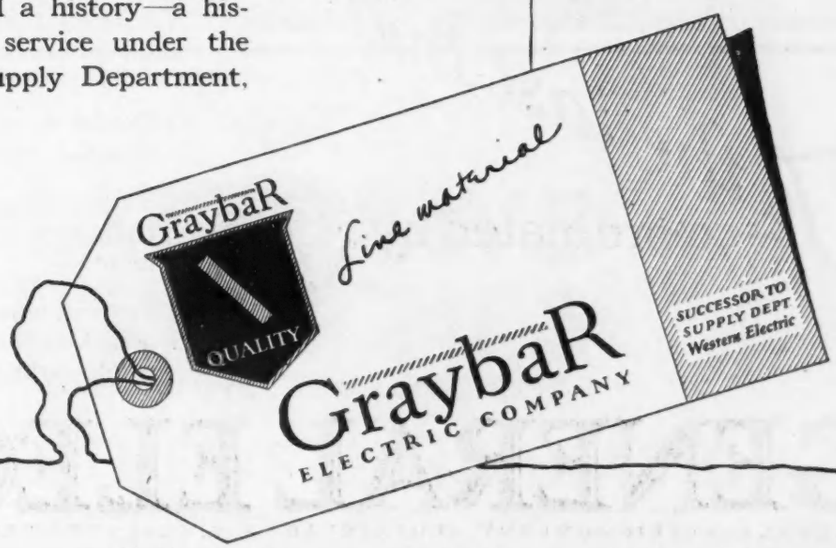
Old Scout

When you want supplies in a hurry put it up to this groundhog

DOES a groundhog travel fastest when you need things quickest? Here's a question every old scout out on the lines can answer—

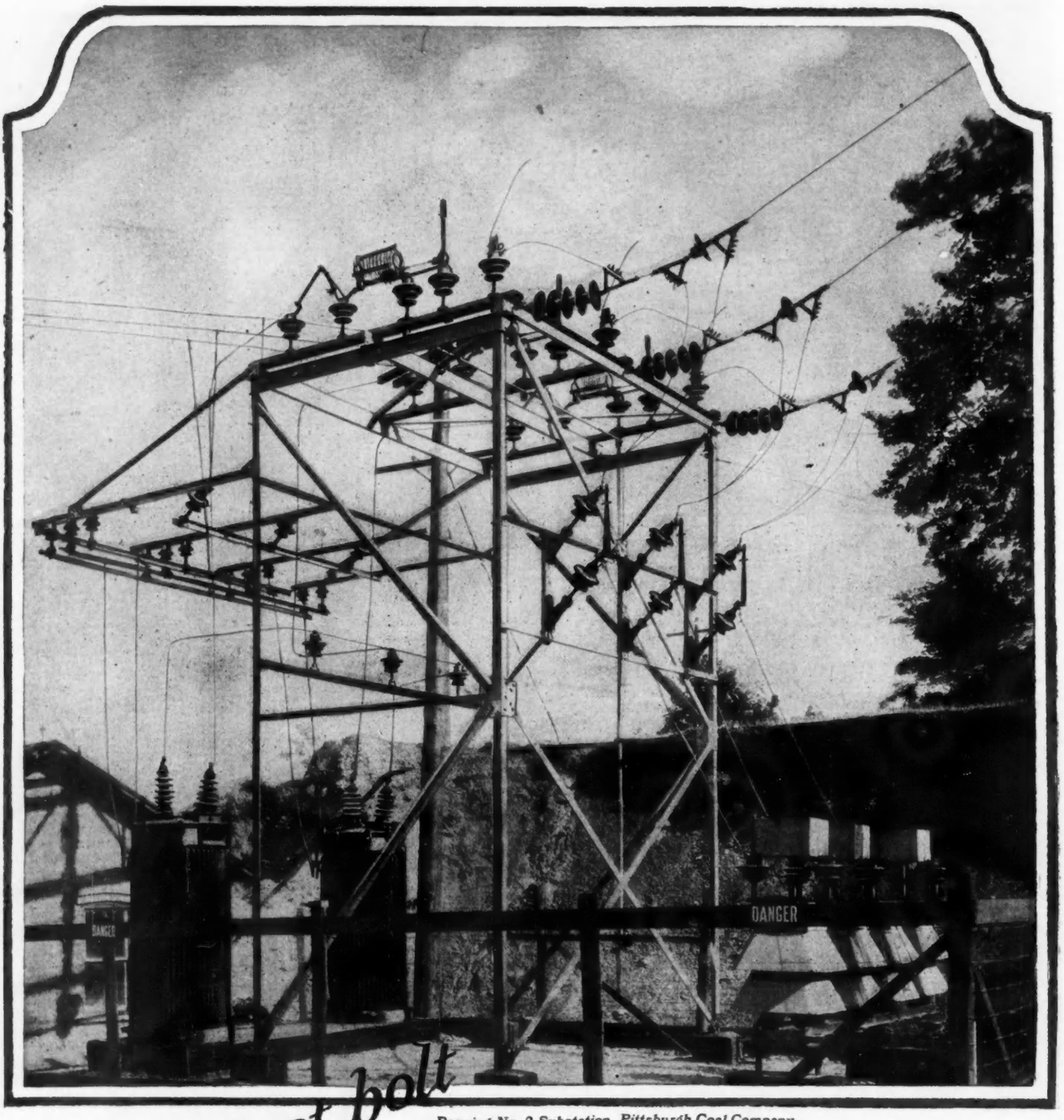
"Yes, when Graybar Electric is the groundhog." For line materials and tools come through from Graybar's ample stocks with a snap and a precision that would do credit to the most faithful of lineman's groundhogs.

Back of that condition are 56 Graybar Electric houses and a history—a history of 56 years' service under the former title of "Supply Department, Western Electric."



Offices in 56 Principal Cities

Executive Offices:
100 East 42nd St., N. Y.



Banning No. 2 Substation, Pittsburgh Coal Company

To the last bolt
—co-ordinated by GE

Desire to make G-E Outdoor Substations foremost—

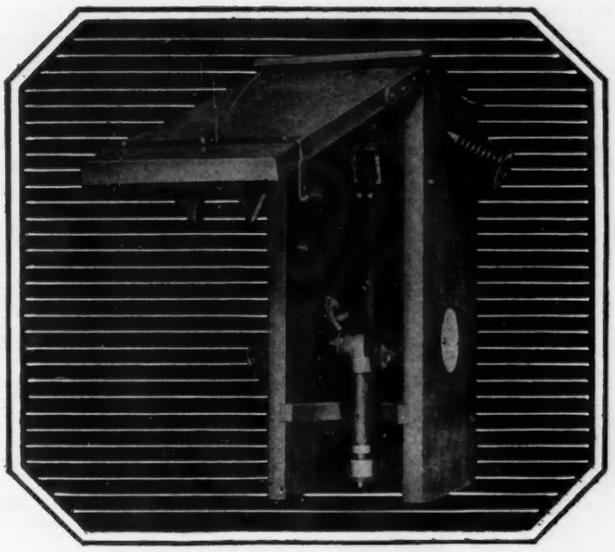
Experience, ability and the resources to furnish apparatus to meet requirements—

Proper combination of these has achieved the outdoor substation that is "co-ordinated by G-E".

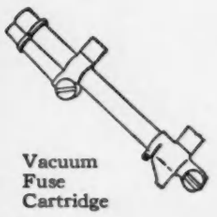
25-25

GENERAL ELECTRIC

GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y., SALES OFFICES IN ALL PRINCIPAL CITIES



Safety
Fuse
Puller



Vacuum
Fuse
Cartridge

Rupturing Capacity—Unknown

To date no company has been able to give Matthews Fuswitches sufficient current at their voltage rating to break them down. 20,000 amperes cleared in 2 cycles by a Type HQ, is the highest yet recorded.

This is the kind of protection and ruggedness you want. It means lower maintenance cost on expensive equipment as well as on fuswitches. We have the proof and we welcome tests. If you want to be shown, write us. You can save money and render better service. All we ask is to let us prove their superiority. From the standpoint of good business, can you afford to pass this by?

Guaranteed for 10 Years

We make Matthews Fuswitch and Disconnecting Switch boxes so good that since February 14th all boxes carry this 10 year guarantee. It takes the guess out of fuswitch buying.

"We hereby guarantee the 'Tidewater' Cypress Boxes with copper covered roofs for encasing the Types OK and HQ Matthews Fuswitches and Disconnecting Swtiches to withstand weathering for a period of ten years from the date of purchase. If the boxes furnished with the above switches crack, check or warp to an extent that would make it necessary to replace them within ten years, then a new wood box will be sent free of cost and carrying charges prepaid to take its place. It will only be necessary to remove the parts of the old switch and replace them in the new box."

Safety

Matthews Fuswitches are designed so that the operator does not have to touch them at any time. They can be completely inspected without disturbing service. A safety Fuse Puller is provided with every pair of Fuswitches to open the door and raise it until the patented catch holds it firmly in place. The safety fuse puller fits into a collar on the fuse cartridge, permitting the operator to disconnect the switch without the slightest danger. Matthews Fuswitches can be reconnected with the same fuse puller.

This safety feature has had much to do with many public utilities adopting Matthews Fuswitches as standard equipment throughout the country. Safety to your men is important.

Learn All

Get the complete story on Matthews Fuswitches and Disconnecting Swtiches. It is really interesting reading. Send for Bulletin 501. It has been the first step towards big savings for many companies.

Ask about these ' ' ' Matthews Fuswitches, Matthews Disconnecting Switches, Matthews Scrulix Anchor, Matthews Adjustable Reel, Matthews Guy Clamps, Matthews Slack Puller, Matthews Cable Clamps, Matthews Lamp Guards, Matthews Telefault, Matthews Teleheight ' ' *Distributors in all Principal Cities.*

MATTHEWS
CORPORATION
ST. LOUIS U.S.A.

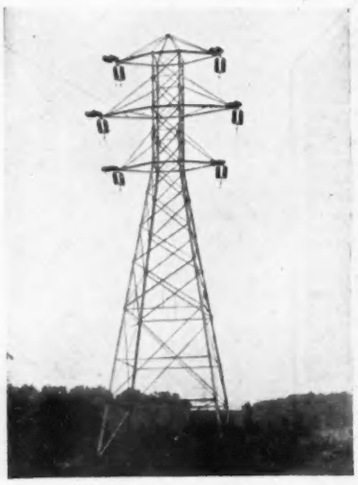
MATTHEWS FUSWITCHES

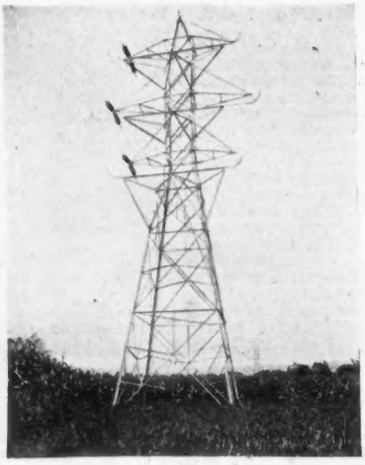
and DISCONNECTING SWITCHES

59

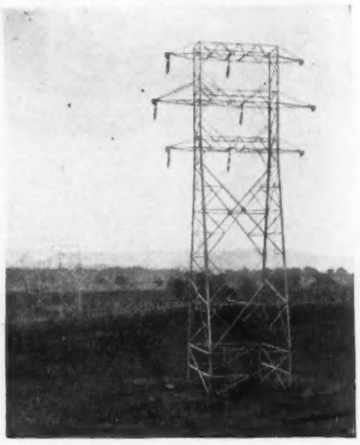
W. N. MATTHEWS CORPORATION

3702 Forest Park Blvd. ' ' St. Louis, U. S. A.





Just a few typical installations of Lehigh Towers. Note the river crossing tower shown below.



Just the Towers for *Your* Lines

The soft coal regions of Virginia, the hills of New York State, the rocky passes of the West, everywhere there are Lehigh Towers constantly serving the country with power. They are just the towers for *your* lines.

Repeat orders from such concerns as Stone & Webster, Inc., W. S. Barstow Management Ass'n., J. G. White Engineering Corp., Phoenix Utility, etc. amply show the quality of Lehigh Service.

High quality steel, thoroughly galvanized, plus experienced engineering service and prompt delivery have made Lehigh Service used everywhere. Have a Lehigh Engineer quote on your requirements.

LEHIGH STRUCTURAL STEEL COMPANY

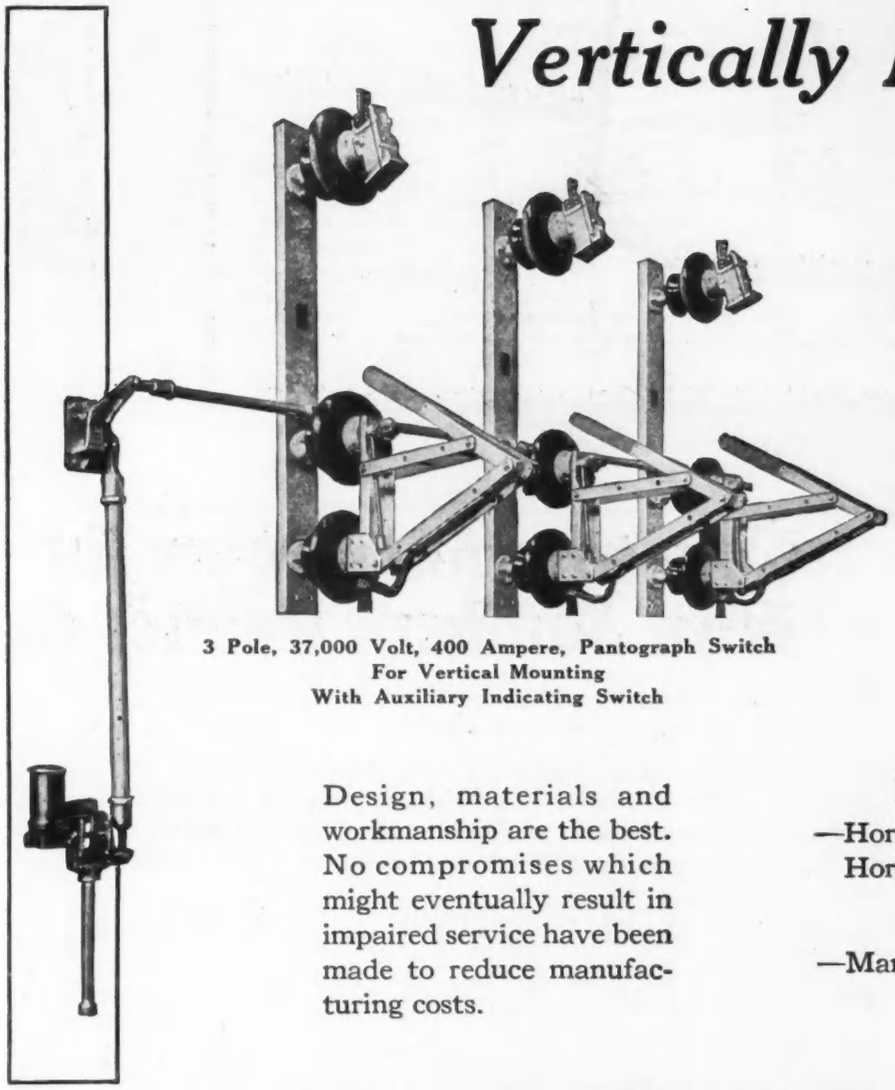
ALLENTOWN, PA.

New York Boston Philadelphia Washington Miami

PANTOGRAPH

The S & C Multiple Pole Switch

Vertically Mounted



3 Pole, 37,000 Volt, 400 Ampere, Pantograph Switch
For Vertical Mounting
With Auxiliary Indicating Switch

The straight line pantograph action results in a high speed positive motion of the switch blade which permits entering a fully housed contact clip with one simple, direct movement.

Design, materials and workmanship are the best. No compromises which might eventually result in impaired service have been made to reduce manufacturing costs.

Mountings
—Horizontal, Vertical, Horizontal Inverted

Operation
—Manual or Motor

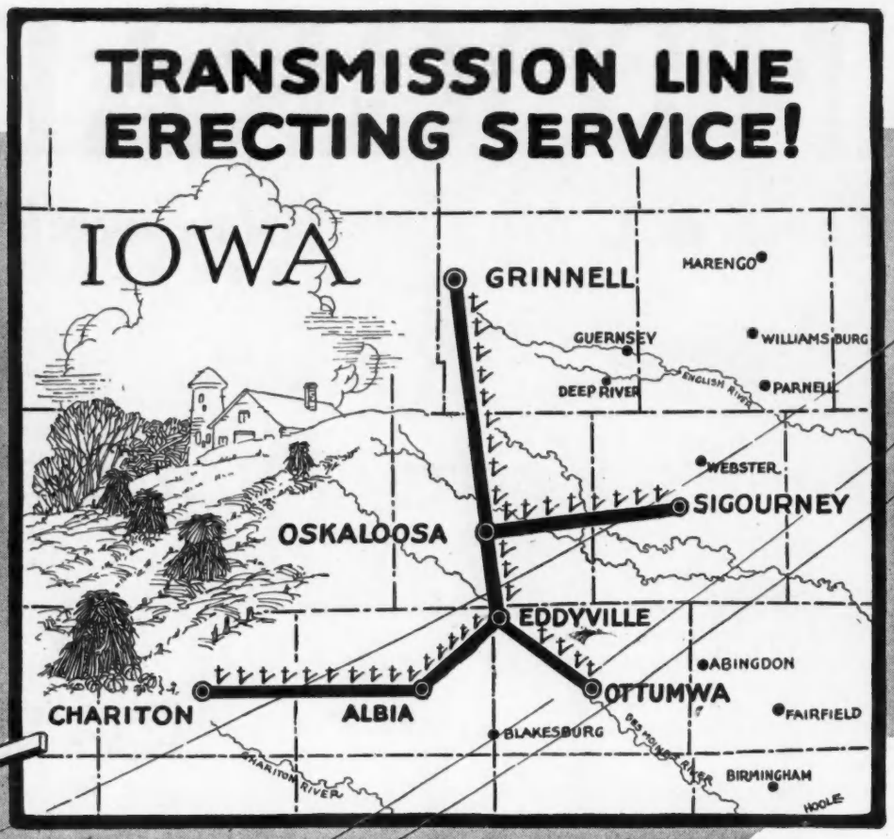
It will pay you to investigate the merits of this switch.

SCHWEITZER S&C CONRAD, INC.

4435 RAVENSWOOD AVENUE CHICAGO, ILLINOIS, U.S.A.

New York	Buffalo	Birmingham	Kansas City	Los Angeles	Toronto
Boston	Pittsburgh	St. Louis	Omaha	San Francisco	Montreal
Philadelphia	Cleveland	Youngstown	Dallas	Vancouver	Winnipeg

TRANSMISSION LINE ERECTING SERVICE!



Construction begins for Iowa Southern Utilities Co.

Hoosier has agreed to complete this 125 mile suspension type line at an average rate of one mile per day.

When completed this line will be the bus supplying electric service to the principal distribution centers of Southern Iowa as well as upwards of 1,000 miles of transmission network, serving nearly 150 cities and towns and hundreds of farmers.

Iowa is the fifth state in which Hoosier has begun operations in 1926.

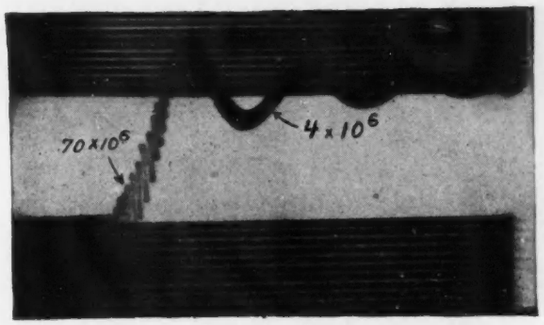
We can materially reduce your construction costs and simplify your present construction problems, doing the work to your specifications in contract time and according to highest construction standards.

You furnish the materials—we do the rest.

Hoosier Engineering Co.

Erectors of Transmission Lines

INDIANAPOLIS

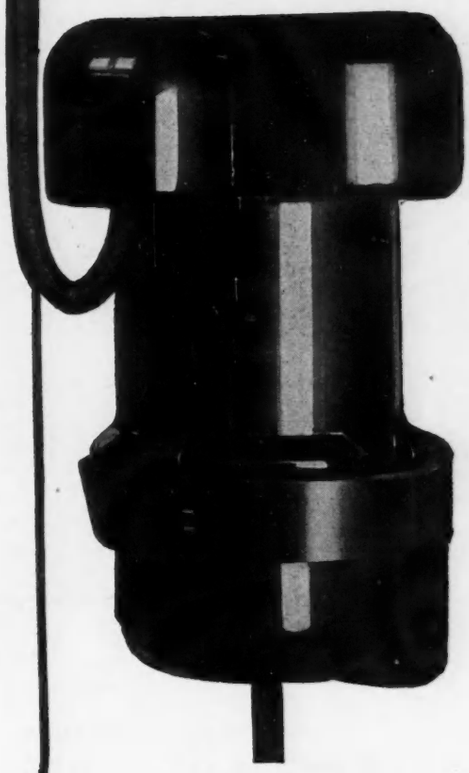


This oscillogram records a discharge from a lightning generator. The timing wave (horizontal lines) takes only $\frac{1}{600,000}$ second to cross the film (an average speed of 40 miles per sec.)

It shows that two surges were produced; one having a frequency of about 4,000,000 cycles and rising to its crest in about $\frac{1}{12,500,000}$ sec. (0.063 micro-sec.) Superimposed on this wave is another which is slowly damped, having a frequency of about 70,000,000 cycles. One cycle of this oscillation occupied an actual space on the circuit of only 14 ft., indicating an almost incredibly high speed, while the wave front was only 3½ ft. long.

Note that a wave with a front only about as long as a man's arm and a frequency of 70,000,000 cycles is not only photographed but is located at about the center of the film. The marvel of this achievement lies in the fact that the operating range of the cathode-ray oscillograph is 7,000 times that of the ordinary oscillograph, which is only about 10,000 cycles.

A publication which fully describes the cathode-ray oscillograph is available for distribution—Number GEA-400



Pellet (Oxide Film) Arrester
—Built for a-c. circuits,
1,000 to 50,000 volts
Discharge characteristics verified by the "electric microscope"

As seen with the "electric microscope"

With the cathode-ray oscillograph it is now possible to record transients having wave fronts less than a microsecond long—to determine with accuracy details of transient phenomena which have hitherto been unknown.

It has required two years of effort on the part of trained engineer-physicists to acquire the technique of operating this instrument and the knowledge to interpret the results.

The research performed by the General Electric Company with this "electric microscope" maintains the high scientific standards established by Steinmetz in his study of lightning phenomena and greatly advances the art of lightning protection.

The oscillogram reproduced gives an idea of the possibilities of this wonderful scientific instrument for the measurement of the speed and other characteristics of lightning arresters.

Oxide Film Arresters, both for station use and distribution circuits, have benefited inestimably from this research.

441-3

GENERAL ELECTRIC

Independence Hall—Philadelphia Floodlighted with Golden-Glow Projectors.

City Hall—Philadelphia Floodlighted—Many Golden Glow Projectors are used.

PHILADELPHIA has invited you to participate in her Sesqui-Centennial Exposition, commemorating one hundred and fifty years of glorious history and uninterrupted progress.

And the Electric Service Supplies Company, for many years one of Philadelphia's leading industrial concerns, welcomes you. A cordial invitation is extended to visit our manufacturing plant at 17th and Cambria Sts.,—North Philadelphia—the home of the famous Keystone line of Railway, Power and Industrial Electrical Equipment.

ELECTRIC SERVICE SUPPLIES CO.

PHILADELPHIA
17th and Cambria Sts.

PITTSBURGH
1123 Bessemer Building

NEW YORK
50 Church St.

BOSTON
88 Broad St.

SCRANTON
316 N. Washington Ave.

CHICAGO
Illinois Merchants' Bank Bldg.

DETROIT
General Motors Bldg.

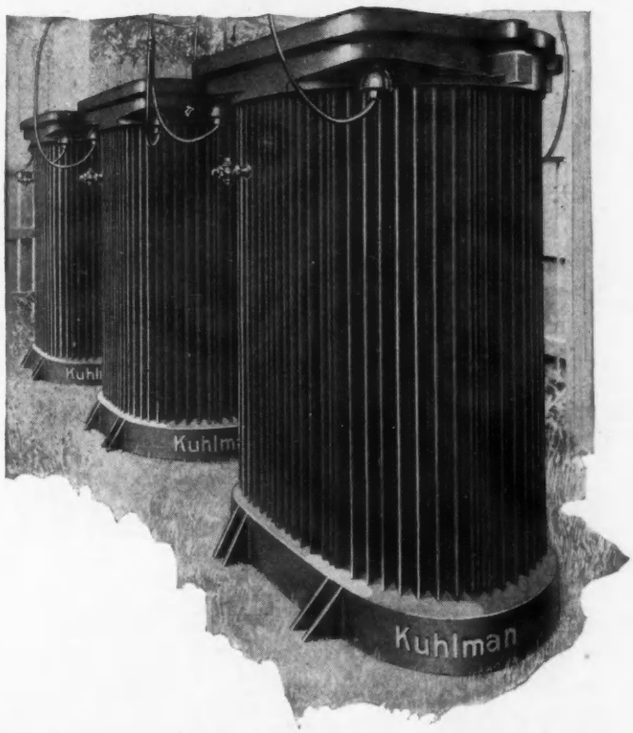
Lyman Tube & Supply Co., Ltd., Montreal, Toronto, Vancouver

Kuhlman Engineers

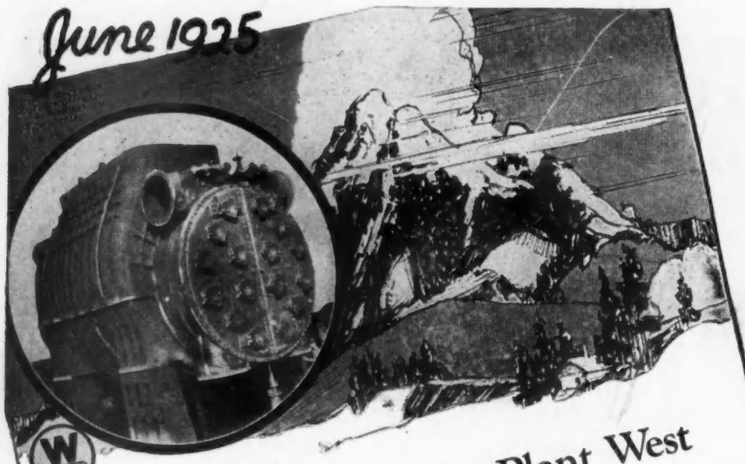
at your service

Chicago, Illinois, 844 Rush St.
New York City, 300 Madison Ave.
Buffalo, New York, John E. Hoffman, 280 Carolina St.
Cleveland, Ohio, 500 East 102nd St.
Toledo, Ohio, Howard J. Wittman, 424 Spitzer Bldg.
Cincinnati, Ohio, Beedle Equipment Co., 1308 Union Trust Bldg.
Boston, Mass., George H. Wahn Co., 69-71 High St.
Baltimore, Maryland, Seaboard Service Co., 206 E. Lexington St.
Milwaukee, Wisconsin, Wm. H. Fernholz, 1031 Clybourn St.
Minneapolis, Minnesota, Grant Sales Co., 917 Marquette Ave.
Indianapolis, Indiana, Scott-Jaqua Co., Inc., 202 Indiana Terminal Warehouse.
Philadelphia, Pa., Continental Sales & Engineering Co., 839 Oliver Bldg.
York, Pa., Harry W. Motter, 335 West Market St.
Allentown, Pa., Irving Samuels, Hunsicker Bldg.
Omaha, Nebr., D. H. Braymer Equipment Co., 727 W.O.W. Bldg.
Seattle, Washington, Equipment Sales, 314 Seneca St.
Denver, Colorado, Globe Electric Supply Co., 1843 Wazee St.
Salt Lake City, Utah, Stevens Sales Co., 134 West 2nd South St.
Tulsa, Oklahoma, Dodge Electric Co., 318 South Boulder St.
Dallas, Texas, F. T. Morrissey & Co., Unit No. 2, Santa Fe Bldg.

Kuhlman Electric Company, Bay City, Michigan



KUHLMAN TRANSFORMERS



In the Largest Steam Plant West of the Rockies

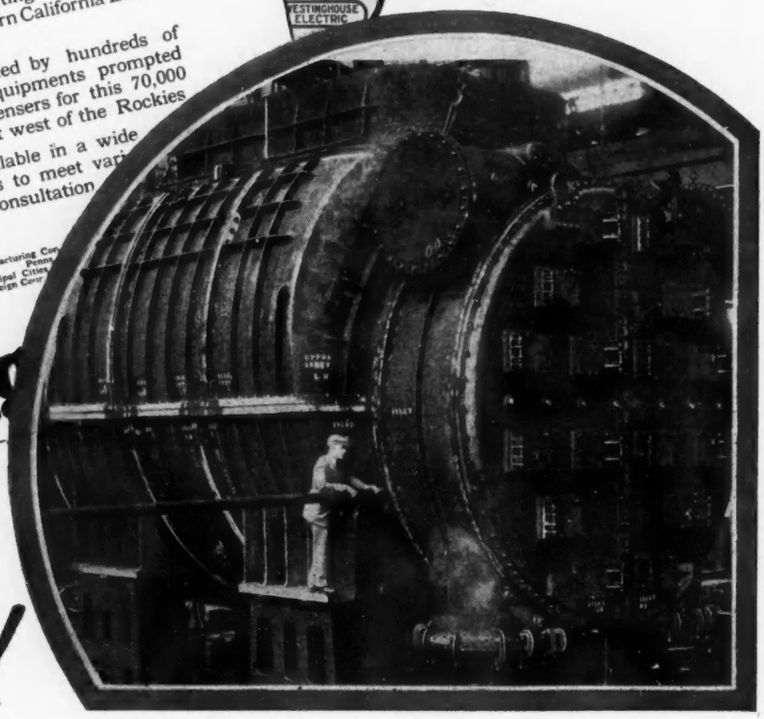
TWO—55000 square foot Westinghouse Surface Condensers and auxiliaries are contributing largely to the successful operation of the new Southern California Edison plant at Long Beach.

The efficient performance maintained by hundreds of other Westinghouse condensing equipments prompted the selection of Westinghouse Condensers for this 70,000 kw. steam power station, the largest west of the Rockies

Westinghouse condensers are available in a wide of capacities and in different types to meet vari ating conditions. Engineering consultation nished without obligation.

Westinghouse Electric & Manufacturing Co
East Pittsburgh Penn
Sales Offices in All Principal Cities
the United States and Foreign Coun

Westing



—and now Another!

JUST a year ago—June, 1925—we published this advertisement in Power Plant Engineering. Now we are installing a 75,000 sq. ft. surface condenser for Southern California Edison.

Westinghouse Electric & Manufacturing Company
South Philadelphia Works Philadelphia, Pa.
Sales Offices in all Principal Cities of the
United States and all Foreign Countries

Westinghouse

X88746

PORCELAIN YOU CAN INSTALL ---*and forget*

Insulators *for* High-Tension Feeders

A reminder from a forgotten insulator on your high tension feeders comes with a jolt. On some stormy night an entire district is without power or light. Your service is criticized and your revenue temporarily cut off.

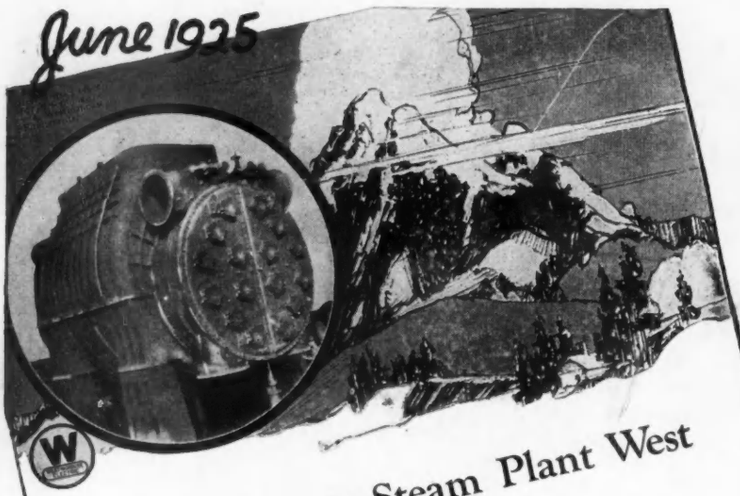
These Westinghouse Insulators can be safely forgotten because each Westinghouse insulator is an engineering and ceramic achievement. Precedent in practice, tradition in process, and custom in design are followed only when they are justified by laboratory and field test. By knowing what we are doing, and why we are doing it, we can give you assurance that tradition and custom could never supply. Westinghouse Porcelain is safe to forget.

Westinghouse Electric & Manufacturing Company
Westinghouse High-Voltage Insulator Works
Derry, Pa. Emeryville, Cal.
Sales Offices in All Principal Cities of
the United States and Foreign Countries

W WESTINGHOUSE ELECTRIC

Westinghouse

X87262



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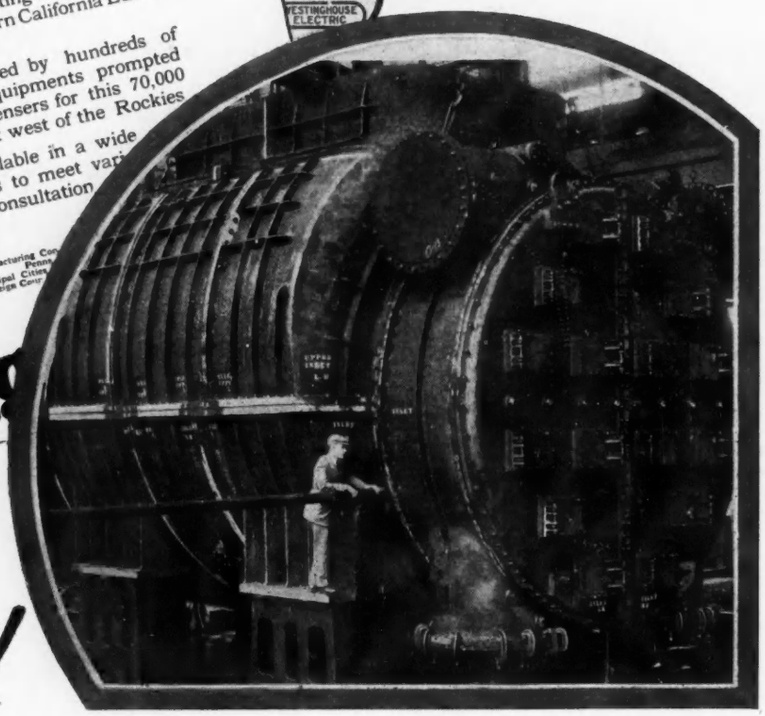

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Sales Offices in All Principal Cities of
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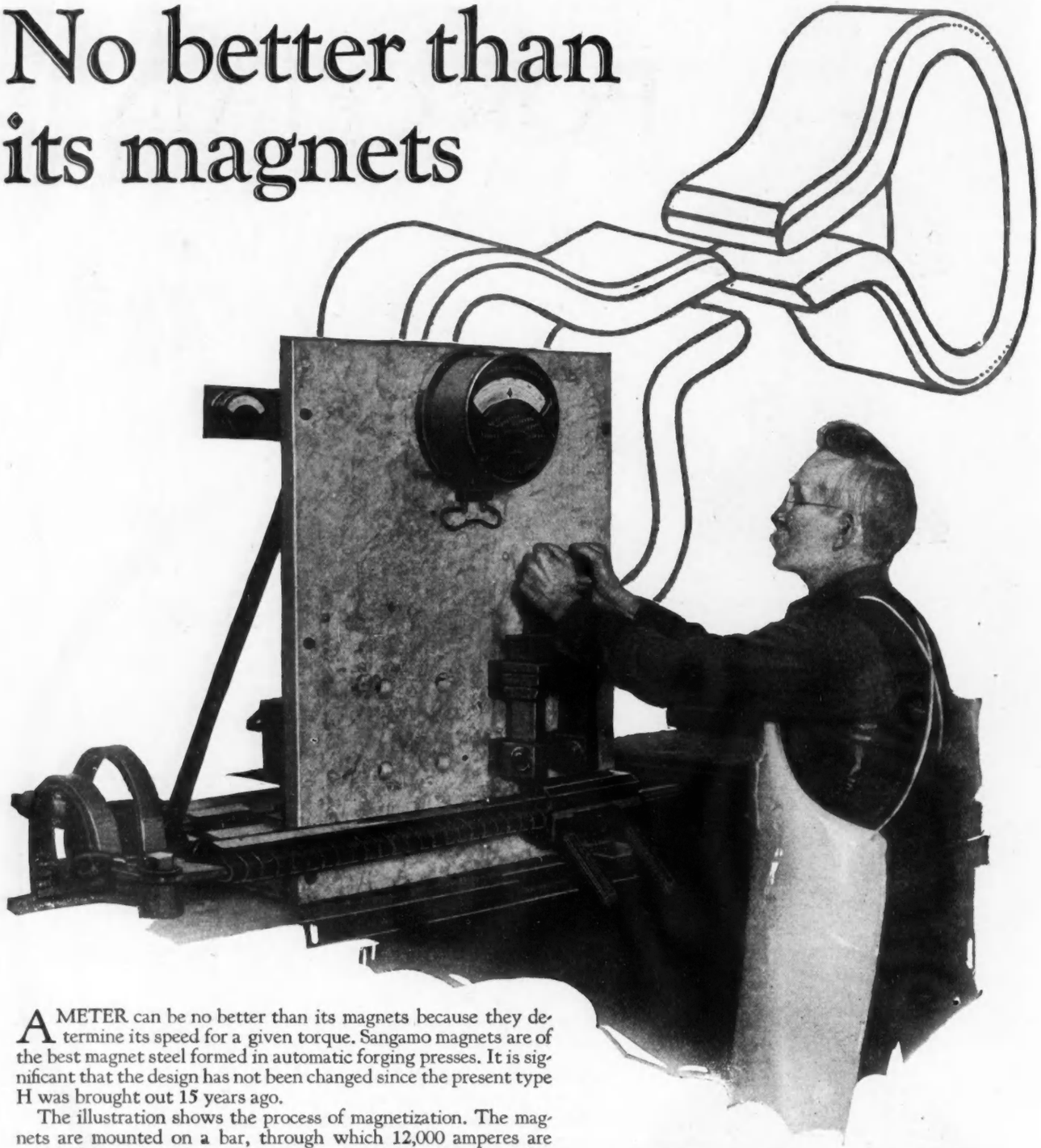
Westinghouse

X87262

No better than its magnets



A METER can be no better than its magnets because they determine its speed for a given torque. Sangamo magnets are of the best magnet steel formed in automatic forging presses. It is significant that the design has not been changed since the present type H was brought out 15 years ago.

The illustration shows the process of magnetization. The magnets are mounted on a bar, through which 12,000 amperes are passed from a special storage battery, creating a tremendous flux directly through each magnet. Later these magnets are artificially aged by partially demagnetizing and then matched in pairs of equal strength. Sangamo magnets are truly permanent unless exposed to a field having greater strength than the one used in the demagnetizing process, which, however, is never encountered under operating conditions.

Both the magnet design and the artificial aging process are Sangamo developments that have proved their worth in years of service; just one example of refinements in the process of manufacture of Sangamo meters that show in after-years as well as in initial performance.

Sangamo Electric Company, *Springfield, Illinois*

New York Boston Chicago Birmingham San Francisco Los Angeles

6331-2

SANGAMO METERS

FOR EVERY ELECTRICAL NEED

SANGAMO

Let light make business bright

Bring light, the cheerful salesman, to your city. Good lighting and good business go hand in hand. Bright streets draw the nightly throngs. Bright shop windows attract attention—and increase sales.

Let a Graybar Electric specialist show you how proper street lighting brightens business and decreases accidents and crime. Too, King street lighting standards add to the architectural beauty of the city, night and day.

GraybaR

ELECTRICAL SUPPLIES

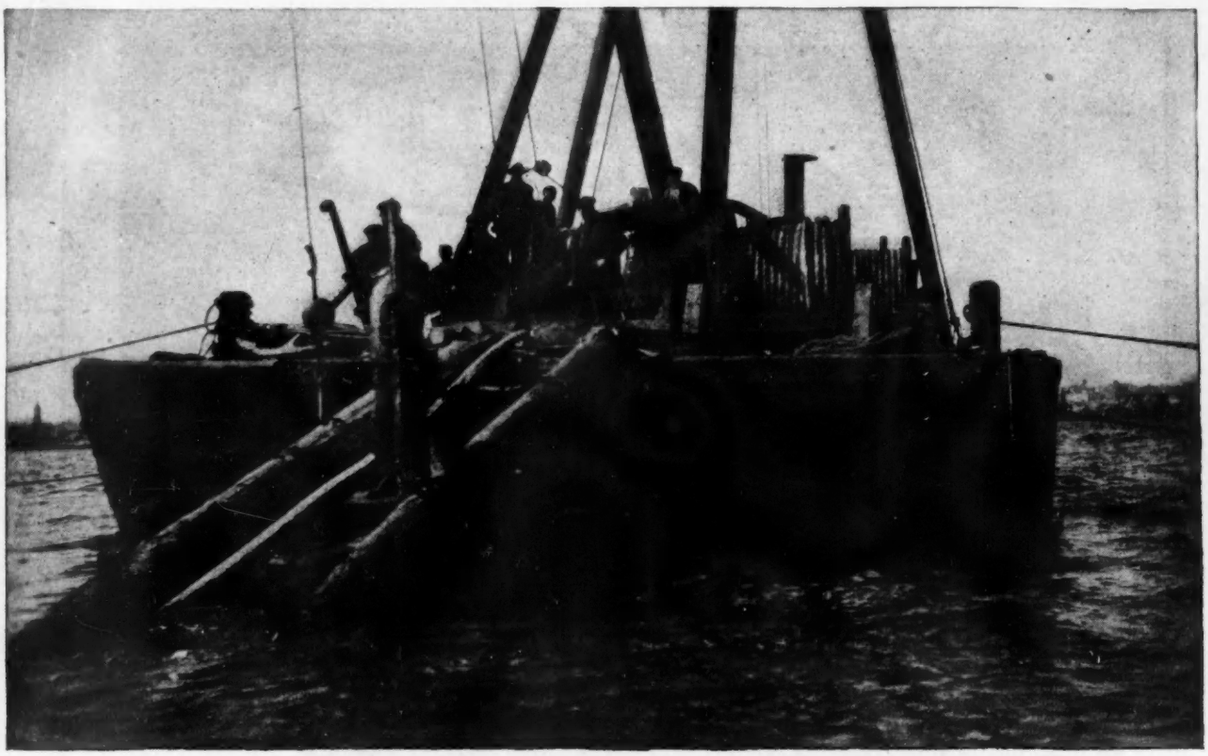
Successor to *Western Electric* Supply Dept.

Offices in 56 Principal Cities

Executive Offices: 100 East 42nd St., New York

Better store lighting follows good street lighting. No retailer on a brightly-lighted street can tolerate dim windows and a gloomy shop; competition demands a light and cheerful store.

Graybar Electric is conducting a constant, consistent campaign to awaken civic officials and business men to a realization of the need for proper street lighting. Let Graybar work with you to this end.



Laying cable across the harbor at New Bedford in 1915

"—very satisfactory in operation since they were installed—"

In 1915, two 23,000-volt 3-phase submarine cables were installed across the harbor at New Bedford by the General Electric Company for the New Bedford Gas & Edison Electric Company. At the time, the voltage of this cable was one of the highest in submarine use in this country.

In May, 1926, after these cables had been in operation under a navigable harbor for more than 10 years, an official of this company wrote:

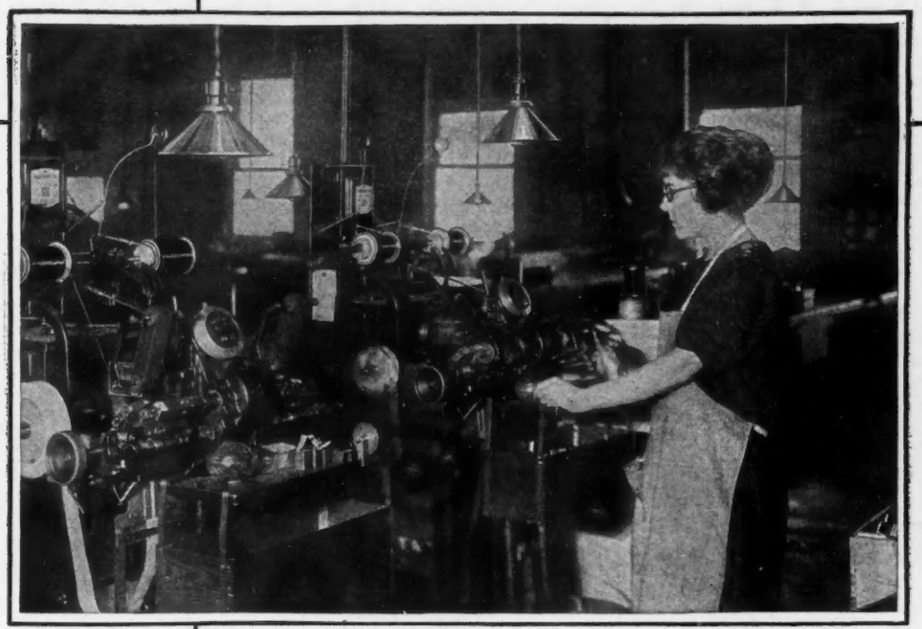
"—These two cables have been very satisfactory in operation since they were installed and they are still going strong—"

Constant improvements in design and manufacture insure that G-E Wires and Cables maintain the consistently uniform high quality for which they are noted.

49-9

GENERAL ELECTRIC

GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y., SALES OFFICES IN ALL PRINCIPAL CITIES



Every step in the production of Beldenamel is under the direct supervision of Belden engineers. The Beldenamel coating is mixed and prepared from raw materials right in the Belden plant according to the special Belden formula.

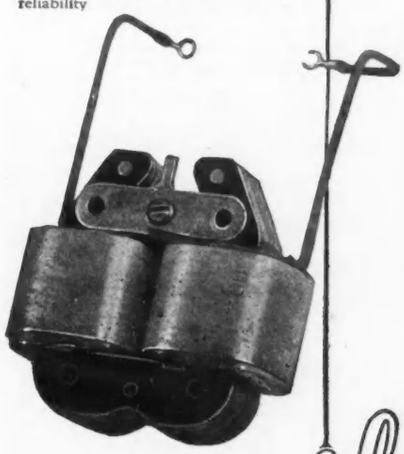
The High Quality of Beldenamel assures Reliability in Watt-hour Meters

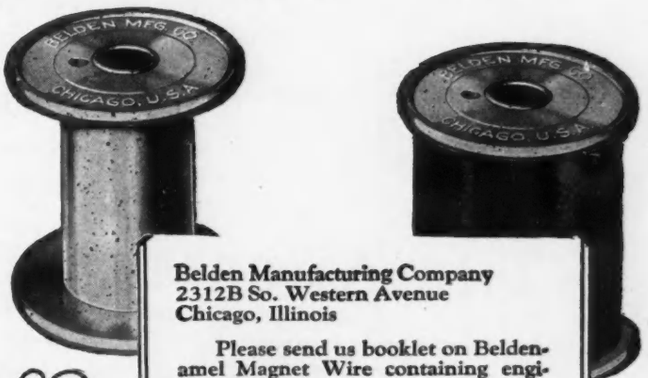
INSTRUMENT manufacturers have found Beldenamel to be the ideal insulated conductor for winding their small instrument coils. Beldenamel not only is a uniformly soft wire, which makes it easy to handle in the winding machines, but it runs uniform in gauge and thickness of insulation.

The quality of Beldenamel insulation is exceptionally high and meets the most rigid inspection requirements, and therefore assures maximum reliability in the finished meters.

Beldenamel wire of the smaller sizes is being supplied on Beldalloy cast, all-metal spools of light weight, perfect balance, and great mechanical strength. Perfect spooling is always obtained, and winding machines can be run at higher speeds without danger of damaging the wire. It will pay you to investigate Beldenamel wire on the Beldalloy spools. Use the coupon.

The watt-hour meter potential coils shown below are wound with Beldenamel magnet wire to assure maximum reliability





Specify Belden

Belden Manufacturing Company
2312B So. Western Avenue
Chicago, Illinois

Please send us booklet on Beldenamel Magnet Wire containing engineering data.

Name.....

Address.....

.....

ANACONDA PHOSPHOR BRONZE

WITHSTANDS — BENDING and FRICTION

PREVENTS — CRACKING and SPARKING

RESISTS — ABRASION and CORROSION

ANACONDA Phosphor Bronze possesses well recognized physical characteristics which make it superior to commercial bronzes and highly desirable for manufactured products that must retain elasticity and resistance to mechanical wear.

Practical experience and research knowledge, acquired during one hundred years of continuous operation, enable the technical staff of The American Brass Company to make helpful, definite recommendations as to the Phosphor Bronze alloy and temper best suited for any particular use.

Anaconda Phosphor Bronze is made in every variety of Sheets, Rods, Wire and Tubes, and can be secured through leading distributors of metal products.

THE AMERICAN BRASS COMPANY

GENERAL OFFICES: WATERBURY, CONNECTICUT

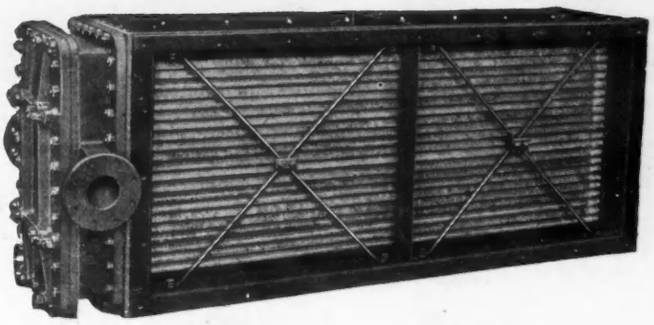
New York, Chicago, Boston
Philadelphia, Providence, Pittsburgh
Cleveland, Detroit, Cincinnati
St. Louis, New Orleans, San Francisco

ANACONDA
from mine to consumer

Mills and Factories:
Ansonia, Conn., Torrington, Conn.
Waterbury, Conn., Buffalo, N. Y.
Hastings-on-Hudson, N.Y., Kenosha, Wis.

In Canada: ANACONDA AMERICAN BRASS LIMITED, NEW TORONTO, ONTARIO

Why Waste This Heat?



The U-fin Generator Air Cooler

uses the turbine condensate to cool the air from the generator windings. By recovering this air heat loss and returning it to the boiler, the overall thermal efficiency is improved, an important item to engineers interested in equipment that will help to reduce fuel costs.

The patented construction of the U-fin Air Cooler also keeps the air dry while being cooled, and prevents dust from being carried to the generator windings.

Furthermore, by using the same air over and over again, generator fire hazard is greatly reduced, for in case of fire the oxygen would soon be exhausted, quickly extinguishing the fire.

Note these **exclusive *features***

1—***Patent Multipass water head***—the cooling water is properly distributed for most effective action.

2—***Shouldered rectangular reinforcing rings***—each pair of tubes is reinforced and the entire tube construction is rigid.

3—***Convenient tube removal***—each pair of U-fin tubes can be withdrawn without removing adjacent tubes.

4—***Special water box construction***—design permits easy inspection of tube interiors.

5—***Condenser type water head***—tube ends can be examined without interfering with duct work or water connections.

6—***No brazed or ferruled joints***—all tubes are expanded into tube plate and return bend, and tubes and return bends are tinned externally.

Send the coupon for full information

The Griscom-Russell Company, Dept. B, 285 Madison Ave., New York

Philadelphia	Chicago		St. Louis	San Francisco
Boston	Detroit		New Orleans	Los Angeles
Rochester	Cleveland		Houston	Seattle
Pittsburgh	Milwaukee		Dallas	Salt Lake City
Columbus	Minneapolis		Atlanta	Tulsa
Indianapolis	Kansas City		Charlotte	Denver

For Canada: Riley Engineering & Supply Co., Ltd., Toronto

Griscom-Russell

Heat Transfer Apparatus

Name.....
Company.....
Address.....

The Griscom-Russell Co., Dept. B, 285 Madison Ave., New York
Please send full information on the U-fin Generator Air Cooler.

EW 6-26-26

Does Much Better than the Average in Merchandising

In a recent report published in this Magazine, it was shown that 132 Central Stations, serving 3,194,935 residential customers, sold a little more than eight-tenths of one per cent of customers during 1925.

The record of Central Stations selling Automatic Washers during 1925 was much better—being one and one-half per cent of customers—or almost twice as many machines per customer as the average.

The Right Machine to Sell

It is very important to choose the right machine—if you seek volume. Here is why the Automatic has shown such unusual sales records:

1. It is a highgrade, honestly built washer, with very little service required after sale.

2. It sells at a fair price—not too low, not too high.

3. Users say: "It does the work beautifully." Almost every one sold will "sell" a neighbor.

We Specialize on Sales Service to Central Stations

If your company does not sell washing machines, we should like to present some information as to the possibilities of a washing machine merchandising department in your own territory.

If your company does sell washing machines, we should like to show you, in advance, just how much business can be developed in your territory on the Automatic plan of co-operation.

Our Merchandising Department will prepare a plan to fit your local situation, simple yet very effective, worked out from many years of successful experience helping dealers and distributors run up big sales. In fact, we can even predict quite accurately, how many machines will be sold in a given time. Ask us to explain.

Public Service Sales Division

Automatic Electric Washer Co.

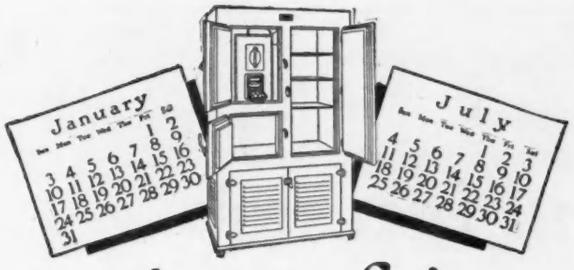
1517 W. Third St., Newton, Iowa

Offices at New York, Philadelphia, Portland, Dallas

In One Month One Central Station Sold

1154 Automatic Washers

Another sold 710	Another sold 181
Another sold 635	Another sold 179
Another sold 406	Another sold 162
Another sold 279	etc., etc., etc.



Is electric refrigeration a seasonal load?

THE art of living constantly improves. Homemakers are learning that food keeps best in a proper temperature in cold weather, just as it does in summer. They can prepare better winter meals with the help of electric refrigeration.

The old custom of placing the refrigerator on the back porch in winter is passing. This "economy" costs more than electric refrigeration. Frozen food spoils quickly after thawing: any temperature below 40 degrees affects the flavor. Refrigerators do not last long either when exposed to the mercy of the weather.

Refrigeration in winter helps provide good meals. Families have even keener appetites for correctly refrigerated food in winter than in depressing hot weather. Frozen delicacies give a graceful touch to any dinner regardless of the calendar. Desserts are easily made in the electric refrigerator, and ice cubes are popular regardless of outdoor weather.

The modern housekeeper has her Servel electric refrigerator handily located in the kitchen and uses it all year round.

True, there is less current used for electric refrigeration in the months that lighting demand goes up, but the off-peak, well diversified load of electric refrigeration fills many of the valleys in winter, as well as in summer. It is year-round business for the electric light and power company:—an ideal power load, distributed over the entire 24 hours and over the entire year.

SERVEL

ELECTRIC REFRIGERATION

Trade Marks SERVEL Reg. U.S. Pat. Off.

6131-11

THE SERVEL CORPORATION, 51 East 42nd Street, New York CHICAGO BOSTON DETROIT MINNEAPOLIS SALT LAKE CITY DENVER ATLANTA SAN FRANCISCO LOS ANGELES SEATTLE DALLAS

Factories: Evansville, Indiana Carteret, New Jersey Newburgh, New York London, England, Servel, Ltd.

The careful investor
judges a security
by the history of its performance

KERITE

in a half-century of continuous production, has spun out a record of performance that is unequalled in the history of insulated wires and cables.

Kerite is a seasoned security.

THE KERITE INSULATED WIRE & CABLE COMPANY INC
NEW YORK CHICAGO

7420

To Build a Modern Plant Consult a Specialist

The design and construction of a modern plant for the electrical industry calls for specialized knowledge and experience quite outside the ordinary range. This involves laying out the plant for the most efficient placing of machinery, with daylight and ventilation scientifically provided so as to result in the best possible workmanship. It means knowing the comparative advantages of multistory and single story construction, for a given volume of production.

This is a day of specialization. The man who designs or builds a house, apartment, theatre or store, no matter how successfully, is dealing with altogether different factors from those involved in a modern plant for the electrical industry.

The Austin Company has made a specialty of industrial plants of this kind, and knows from long study and experience the proper layout for getting most usable floor space, with good working conditions, per dollar invested.

When you give Austin the contract for your building, you deal with just one organization, with no division of responsibility. Architectural service, engineering, building construction, all are covered by one contract, which guarantees in advance the total cost of the completed plant, the delivery date (with bonus and penalty clause if preferred), and the quality of materials and workmanship.

Austin's nation-wide organization is prepared to serve you promptly, anywhere. Costs and other valuable building data will be furnished immediately upon request.

Wire, phone the nearest office, or mail the coupon.

THE AUSTIN COMPANY *Engineers and Builders* Cleveland

New York Cleveland Philadelphia Seattle Chicago Detroit Portland Miami
Birmingham Pittsburgh St. Louis

The Austin Company of California: Los Angeles and San Francisco
The Austin Company of Texas: Dallas

AUSTIN

Complete Building Service

THE AUSTIN COMPANY, Cleveland

We are interested in the erection of a .....building.....x....., number of stories.....

You may send me a personal copy of "The Austin Book of Buildings" free to Industrial Executives.

Firm .....

Individual .....

Street ..... City.....

E. W. 6-26-26

CROFT MEN WIN

See this great set FREE

THESE eight practical, easily-understood books have prepared thousands of men for big-pay electrical jobs. They have the complete knowledge that a man must have to hold down the big jobs—the responsible jobs—the jobs that pay from $3,000 to $5,000 a year.

With the Croft books you can advance yourself steadily. You can increase your earnings quickly and surely. You can make yourself an expert and be worth the money that experts get—anywhere in the electrical field.

Free examination of the books will convince you. The free trial alone will be worth money to you. Deciding to have a look at the Croft Library now will cost you nothing and it will prove to be one of the most profitable things you ever did.

It costs nothing and it means everything. Let the coupon be your answer.

The Croft Library

No course, no set of books offers a quicker, surer method of mastering electricity than the Croft Library. It is a complete electrical educator. It is founded on practice—on work as it is actually done. It is jammed from cover to cover with the kind of hard-headed facts you want. Written so that the beginner can easily understand it, yet so sound, so thorough, that it is the daily guide of thousands of highly paid electrical workers and engineers.

Croft and success go hand in hand. If your electrical training is obtained from these great books you are certain to win your way to the top.

FREE A copy of Bishop's—ELECTRICAL DRAFTING AND DESIGN will be given free to every person who subscribes for the Croft Library now. See coupon for details.

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Fill in, mail the coupon attached and we will send you the entire set of eight volumes for ten days' Free Examination. We take all the risk—pay all charges. You assume no obligation—you pay nothing unless you decide to keep the books. Then $1.50 in ten days and the balance at the rate of $2.00 a month. Send the coupon NOW and see the books for yourself.

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The following information has been summarized from a letter to us from Mr. Geo. N. Tidd, Vice-President of The Ohio Power Company and President of American Gas and Electric Company:

THE COMPANY

The Ohio Power Company owns and operates large electric power and light generating plants and transmission and distributing systems in important manufacturing and mining sections of Ohio. Transmission and distributing lines owned, including properties about to be acquired, aggregate 3,468 miles, and supply electric power and light to 225 communities in a prosperous territory in Ohio, serving an estimated population of 719,000. The company's main power stations are located at Philo, Ohio, and Power (formerly Windsor), West Virginia. All the electric power and light properties owned (including those about to be acquired) by the company are interconnected by high voltage transmission lines, and this system in the State of Ohio is connected with the high voltage lines of other subsidiaries of American Gas and Electric Company. These interconnected high voltage lines extending into six states constitute one of the largest super-power systems in the world.

SECURITY

The First and Refunding Mortgage Bonds (of which $43,131,500 will be outstanding upon completion of the present financing) are secured by direct mortgage lien on the plants and properties of the company, valued at over $63,000,000, based on an appraisal made by Messrs. Ford, Bacon & Davis in 1921, with subsequent additions at cost. The mortgage is a first lien on the greater part of the company's property; on the remainder it is subject to $2,731,000 divisional bonds outstanding under closed mortgages. All these divisional lien bonds must be paid at maturity and not extended.

PURPOSE OF ISSUE

The proceeds of these Series D Bonds will be used to provide funds in connection with the purchase of important electric power and light properties in Ohio, to reimburse the company in part for capital expenditures already made under the terms of the mortgage, and for other corporate purposes.

EARNINGS

Gross and net revenues have steadily increased. During the three-year period ended April 30, 1926, as shown below, annual gross earnings of all properties owned, including those about to be acquired, increased $1,857,205, or over 14%, and total annual net revenue available for bond interest, after taxes, maintenance and depreciation charges, increased $1,048,552, or over 21%.

Twelve Months Ended April 30	Gross Earnings	Total Net Revenue
1924	$12,646,083	$4,825,873
1925	13,267,280	5,203,385
1926	14,503,288	5,874,425

Annual interest charges on the First and Refunding Mortgage Bonds to be outstanding on completion of the present financing, including this issue of Series D Bonds, and on all underlying divisional bonds, amount to $2,539,480. The average of the annual net revenue, as shown above for the three years ended April 30, 1926, was equal to more than twice the amount of such interest charges.

CONTROL BY AMERICAN GAS AND ELECTRIC COMPANY

The entire common stock of The Ohio Power Company is owned by American Gas and Electric Company, which has paid dividends on its preferred and common stock without interruption for more than 15 years. The aggregate market value of the stock of American Gas and Electric Company is about $130,000,000 at current quotations.

The statements quoted above have been accepted by us as accurate but are in no event to be construed as representations by us.

We offer these bonds for delivery if, when and as issued and accepted by us, subject to approval of legal matters by counsel, and to approval of the issue of the bonds by the Public Utilities Commission of Ohio. It is expected that delivery in the form of temporary bonds of the company or interim receipts of Dillon Read & Co. will be made on or about July 7, 1926.

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ENGINEERING executive wanted, technical graduate, with not less than ten years' experience in public utility work, or the equivalent. Steam and hydro plants and transmission, distribution and public relations. Location Middle West. Give experience and send photo in first letter. P-204, Electrical World, 7 So. Dearborn St., Chicago, Ill.

FOREMAN and assistant foreman relay maintenance, having at least three years' experience with large utility company. College education preferred but not necessary. State age and when available. Location, New York City and vicinity. Weekly rate assistant foreman $37.00 to $45.00, foreman $45.00 to $50.00. P-240, Electrical World, Tenth Ave. at 36th St., New York.

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1	40	1700	220/440	Westg. sl. rg.
1	35	1200	220	Cr.-Wh. synch.
1	25	1200	440	G. E. K
1	25	900	220	West C. S.
1	10	900	220	Westg. HF.
1	7½	900	220/440	G. E. MT.
2	2	1800	220/440	G. E.

(2 Phase Motors on request)

D. C. GENERATORS—250 VOLT

No.	Kw	Rpm.	Type
1	75	450	Diehl
1	50	600	Westg.
1	30	1000	Westg.
3	21	1250	Sprague

(Smaller sizes on request)

D. C. GENERATORS—125 VOLT

5, 10, 20, 22, 35, 50, 75, 2-100 kw.

D. C. MOTORS—230 VOLT

No.	Hp.	Rpm.	Type
1	150	1100	West. SK
1	100	625	Westg. type S
1	90	470	G. E. CL
1	80	510	Allis-Chalmers
4	75	475	Westg. type S
1	75	850	Diehl
1	50	560	Westinghouse SK
1	50	200	Diehl
1	50	650	Sprague
1	40	400	Diehl
1	40	1300	Diehl
1	35	200	Diehl
1	35	700	Cr. Wheeler
1	35	420	Diehl
1	30	500	Diehl
1	25	600	Sprague
1	20	665	Diehl
1	20	200	Diehl
1	20	900	Diehl
1	15	1050	Cr. Wheeler CM
1	15	925	G. E. CVC
1	10	375/750	Westg. S var. sp.
10	10	1350	Rochester
1	7½	1150	Sprague C
1	5	1200	G. E. RC
1	3	1200	G. E. CVC

(Smaller sizes on request)

D. C. MOTORS—125 VOLT

1	20	650	G. E.
1	15	775	SK Westg.
1	5	700	Diehl
3	3	1100	G. E.
2	3	1700	G. E.

SALESMEN WANTED

Sales Manager

Position available with long established manufacturing company. Executive ability and successful experience in handling salesmen and manufacturers' representatives essential. Must understand problems of selling to utilities and large industrial plants. Should preferably be electrical engineer familiar with electrical transmission and distribution. All correspondence will be considered confidential. SW-236, Electrical World, 7 So. Dearborn St., Chicago, Ill.

REPRESENTATIVES WANTED

High Class Electrical Sales Representatives wanted by the undersigned who are manufacturers of carbon, graphite, electrographitic and metallic brushes for motors and generators, also general line of carbon specialties. Exclusive rights given to each of territories on liberal straight commission sales proposition. Specify in detail past engineering and sales experience. Application by letter. Pure Carbon Company, Wellsville, N. Y.

REPRESENTATIVES AVAILABLE

English Representation

Managing director of leading English importers of electrical materials, now traveling in United States, would be glad to communicate with manufacturers of alloys for electric wires and similar apparatus. Address G. W. Sheldon & Co., 115 Broad Street, New York City.

Manager Director of Leading English Importers

of electrical materials, now traveling in United States, would be glad to communicate with manufacturers of asbestos covered copper wires and similar specialty insulations. Address G. W. Sheldon & Co., 115 Broad Street, New York.

PATENT ATTORNEY

Patent-Sense. Valuable book (free) for inventors seeking largest deserved profits. Write Lacey & Lacey, 768 F St., Washington, D. C. Established 1869.

EDUCATIONAL

Bliss Electrical School

Condensed course in electrical engineering. Complete in one year. For men of character, ambition and limited time. Theoretical principles and practical applications of electricity. Mathematics, steam and gas engines, mechanical drawing, extensive shop work. Construction, installation, testing. Fireproof dormitories, dining hall, laboratories, shops. Established 1893. Send for catalog. 536 Takoma Ave., Washington, D. C.

OFFICIAL PROPOSALS

Bids: July 20.

Electrical Equipment for Holland Tunnel

New York, N. Y.

Sealed bids will be received by the New York State Bridge and Tunnel Commission and New Jersey Interstate Bridge and Tunnel Commission at the office of the Commissions, Room 3004, Woolworth Building, New York City, until 1:30 o'clock p.m. (Eastern Standard Time), Tuesday, July 20th, 1926.

For furnishing and installing equipment for lighting the tunnels, approaches, plazas and ventilation buildings; also furnishing and installing traffic signals, telephones, switchboards for control of oil switches and motors, control and power wiring, 440 volt truck type oil switches, distribution transformers, operating and protective relays, carbon monoxide recording apparatus, a complete supervisory system and miscellaneous equipment, known as Contract No. 19 of the Holland Tunnel.

At the above place and time the bids will be publicly opened and read. The award of the contract, if awarded, will be made by the Commissions as soon thereafter as practicable. The Commissions reserve the right to reject any and all bids.

Bonds in the sum of One Hundred Thousand ($100,000) Dollars each to the State of New York and to the State of New Jersey will be required for the faithful performance of the contract.

OFFICIAL PROPOSALS

No bids will be received or considered unless accompanied by two certified checks upon a National or State Bank or Trust Company, satisfactory to the Commissions and located in New York City or the cities of Newark or Jersey City in the sum of Twenty Thousand ($20,000) Dollars each, one payable to the order of the "Comptroller of the State of New York," and the other to the order of "The New Jersey Interstate Bridge and Tunnel Commission."

The time allowed for the completion of the work is seven (7) months after the date of the delivery of the contract.

Books containing forms of invitation to bid, proposals, contract, specifications, bond, contract drawings, etc., can be purchased at the office of the Commissions for the sum of $5.00, payable in cash.

New Jersey Interstate Bridge and Tunnel Commission.

THEODORE BOETTGER,
Chairman.

New York State Bridge and Tunnel Commission.

GEORGE R. DYER,
Chairman.

U. S. Government

TREASURY DEPARTMENT, Supervising Architect's Office, Washington, D. C., June 8, 1926.—SEALED PROPOSALS will be opened in this office at 3 p.m., July 7, 1926, for remodeling the electric passenger elevator in the U. S. Post Office and Court House, Shreveport, La. Specifications may be obtained at this office in the discretion of the Supervising Architect. Jas. A. Wetmore, Acting Supervising Architect.

U. S. ENGINEER OFFICE, Florence, Ala.— Sealed proposals will be received here until 11 a.m. July 20, 1926, and then opened, for furnishing, delivering and erecting transformers, high tension switching equipment, structures and accessories for Wilson Dam, Tennessee River. Further information on application.

America's Bargain Center for Electrical Machinery

GREGORY HI-GRADE-REBUILT ELECTRIC MOTORS can be bought at a decided saving, yet giving the same service as the best new ones. We have them in practically all sizes and for all different kinds of current, both direct and alternating. We specialize in prompt shipments from stock, having a half-million dollar stock on our floor at all times, mostly all overhauled and crated for immediate delivery.

3 phase, 60 cycle motors in stock.

Qu.	Hp.		Speed
1	20	Siemens-Schuckert (made in Germany), 220 v., slip-ring, with drum controller and resistance	1740
6	20	G. E., type KT, 220 v	1200
2	20	Westinghouse, type CS, 220 v	1160
1	20	Allis-Chalmers, type AN, 220 v	1140
1	20	Westinghouse, type CCL, 440 v., with C-H Bull, 9620, push buttont ype, automatic starter	1120
2	20	G. E., form K, 220 v	900
5	20	G. E., type KT, 220 v., new	900
1	20	G. E., form M, 220 v., slip-ring	900
2	20	Westinghouse, type CS, 220 v	860
1	20	Westinghouse, type CCL, 220 v	850
8	20	G. E., form K, 220 v	720
2	20	G. E., form K, 440 v	720
1	20	G. E., form K, 440 v., with C-H Bull, 9620, push button type, automatic starter	720
1	20	G. E., form M, 220 v., slip-ring	600
1	20	Westinghouse, type CS, 220 v	575
1	22½	Lincoln, 220 v	900
1	25	Western Electric, type CS, 440 v	1200
1	25	G. E., type KT, 220 v., new	1200
1	25	Westinghouse, type CCL, 220 v	1135
1	25	Wagner, type BP, 220 v	900
8	25	G. E., form K, 220 v	900
4	25	G. E., type KT, 220 v	900
1	25	G. E., type KT-346 (55°), 220 v., special totally enclosed	900
1	25	G. E., type KT-346 (55°), 220 v., explosion proof—totally enclosed	900
5	25	Westinghouse, type CS, 220 v	860
1	25	Crocker-Wheeler, 440 v., with C-H Bull, 9620, push button type, automatic starter	850
1	25	Westinghouse, type CCL, 220 v	850
1	25	G. E., form M, 220 v., slip-ring, variable speed	840
1	25	Westinghouse, type CS, 220 v	690
1	25	G. E., type KT, 220 v	600
2	25	Westinghouse, type CX, 440 v	580
2	30	Cleveland, type M, 220 v	3600
1	30	Fairbanks-Morse, type BV, 220 v., slip-ring	1200
1	30	Allis-Chalmers, type AN, 440 v., double shaft extension	1160
1	30	Westinghouse, type CW, 220 v, slip-ring	1160
1	30	Wagner, type BP, 440 v	1140
1	30	Allis-Chalmers, type AN, 220 v., induction motor, direct-connected to American Well Works, single stage, centrifugal pump, capacity 470 gals. per min	1130
1	30	Westinghouse, type CS, 440 v	860
1	30	Westinghouse, type CCL, 220 v	840
1	30	G. E., form K, 440 v	720
2	30	Westinghouse, type CX, 440 v	580
3	30	Allis-Chalmers, type AN (40°), 440 v	575
1	35	G. E., form M, 220 v., slip-ring	900
1	35	G. E., form K, 440 v., induction motor, direct-connected to American, single stage centrifugal pump, capacity 1,600 gals. per min	870
1	40	G. E., form K, 220 v	1200
1	40	G. E., type MT, 220 v., new, slip-ring	1200
1	40	Westinghouse, type CW, 220 v., slip-ring	1160
1	40	Westinghouse, type CS, 220 v	1160
2	40	G. E., type MT, 440 v., slip-ring new	720
1	40	Westinghouse, type CS, 220 v	695
1	40	Westinghouse, type CX, 220 v	580
2	40	Westinghouse, type CX, 440 v	580
1	50	G. E., type MT, 2200 v., slip-ring	900

NOTE:—We have oil circuit breakers, drum starters and resistance for all motors slip-ring 50 H.P. and larger.

Qu.	H.P.		Speed
1	50	Westinghouse, type CS, 220 v	870
1	50	Allis-Chalmers, type AN, 440 v	860
1	60	G. E., form K, 220 v	1800
1	60	Allis-Chalmers, type AN, 440 v	1750
1	60	Westinghouse, type CW, 220 v, slip-ring	1200
1	60	G. E., form M, 440 v., slip-ring	900
3	60	G. E., type MT, 440 v., slip-ring	720
1	60	G. E., form K, 220 v	600
1	62	G. E., form M, 220 v., slip-ring, variable speed (intermittent duty), for crane or hoist service	1200
1	75	Allis-Chalmers, type ANY slip-ring 220 v.	1750
1	75	Westinghouse, type CS, 220 or 440 v., direct-coupled to Sturtevant, horizontal discharge, centrifugal pressure blower, capacity 10,000 cu. ft. air per minute	1750
1	75	G. E., type TRB, 220 or 440 v., revolving field, synchronous motor	1200
1	75	Westinghouse, type CX, 440 v	850
1	75	Fairbanks-Morse, type BV, 440 v., slip-ring	690
1	75	Westinghouse, type CW, 220 v., slip-ring	435
1	100	G. E., form KT, 220 v	900
1	100	Crocker-Wheeler, 440 v	865
1	100	Gould, form M, 220 v., slip-ring	800
1	125	Westinghouse, type CW, 2200 v., slip-ring	675
1	150	Electric-Machinery, revolving field, 2200 volt, synchronous motor	900
2	150	Fairbanks-Morse, type BV, 220 v., slip-ring, constant speed (short shaft for direct-connection)	600
1	200	G. E., form K, 2300 v	900
1	200	G. E., form M, 4000 v. (Y) or 2300 v. (Delta), slip-ring, constant speed	600
1	240	G. E., type ATI, revolving field, 2300 v., synchronous motor (with short shaft for direct-connection)	514
1	250	Westinghouse, type CX, 440 v	850
1	300	G. E., type I, form M, 440 v., slip-ring (3 bearing)	1200
2	300	Gen. Elec., type ATI, revolving field, 2300 v., synchronous motor (with short shaft for direct-connection)	
		2300 volts	514
		220 or 440 volts	514

Note—We have an equally large stock of direct current motors—all kinds, sizes and makes.

This is only a partial list of our stock—send for our monthly bargain sheet, showing complete description of all machines with net prices. High grade motors, generators, transformers, bought, sold, rented and exchanged.

GREGORY ELECTRIC COMPANY

Offices and Works: 16th, Lincoln and Wood Streets, Chicago, Ill.

FREQUENCY CHANGERS

25 to 60 Cycle

3—500 kva., General Electric Generator, 2400 volt, 62½ cycle. Motor 6600 volt, 25 cycle.

ROTARY CONVERTERS

General Electric, 125-250 volt D.C., 25 cycle on A.C. side.

2—400 kw., 2—750 kw., 2—1500 kw., 2—2000 kw.

ALSO—25 cycle Transformers and 3 phase Squirrel Cage and Slip Ring Motors.

Practically any equipment that a distribution system or an industrial plant might require.

W. C. Blair, *Industrial Engineer*

KANSAS CITY POWER & LIGHT CO.

Grand Avenue at 14th Street, Kansas City, Mo.

TRANSFORMERS

60 CYCLE

3—1000 kva. Westgh. 6600 vs. prim. to 2200 vs. secy.
3—500 kva. Gen. Elec. OISC, type H, 11000/10725/10450/10175 vs. prim to 2400/2200 vs. secy.
3—400 kva. Ft. Wayne 11000 vs. prim. to 220/440 vs. secy.
3—333 kva. Fort Wayne, General Electric, type H, 13200/6600 vs. prim. with taps for 12870/12540/12210/11880—to 2300/4000 vs. secy.
3—200 kva. Gen. Elec. 11500 volts prim. 2200 vs. secy.
3—150 kva. Gen. Elec. 11000/22000 vs. prim. to 550/2200 vs. secy.
3—150 kva. Gen. Elec. type H, 22000/20020 vs. prim. to 2300/1150 vs. secy.
3—150 kva. Gen. Elec. 2200 vs. prim. to 120/240 vs. secy.
3—100 kva. Gen. Elec. type H, 13800 vs. prim. 230/460 vs. secy.
3—100 kva. Westgh. 6600 vs. prim. to 2300/2000 vs. secy. type S.K.
4—100 kva. Westgh. 6600 vs. prim. to 440/220 vs. secy.

ARCHER & BALDWIN, Inc.

126 Liberty St., New York City

Telephone—Rector 4025

The ELECTRIC SERVICE CO. Inc.

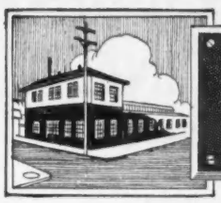
America's Used Transformer Clearing House

212 Walnut Street Cincinnati, Ohio

TRANSFORMERS

WE BUY TRANSFORMERS
WE REWIND TRANSFORMERS
WE SELL NEW AND USED TRANSFORMERS

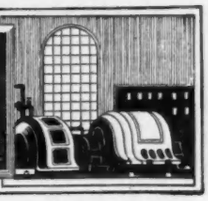
Would you buy a new Transformer from the manufacturer that is not Impregnated?
Then why should you have your Transformers rewound and not Impregnated?
***You Should Not*—For it is recognized by all manufacturers today that a Transformer that is not Impregnated cannot stand up.**
We Impregnate all Transformers that we rewind—A Card will bring complete information and prices.



STEPHEN HALL & CO.

Incorporated

7th and Adams St's, Hoboken, N.J.



TELEPHONES: New York Direct Wire: Rector 3891; HOBOKEN 3750

New and Used Electrical Equipment—Condition Guaranteed—Ready to Ship

Slip Ring Motors—3-phase, 60-Cycle

h.p.	Volts	Speed	Make	Type
200	2200	600	General Electric	M
200	220/440	600	General Electric	M
150	2200	600	General Electric	M
150	2200	720	General Electric	M
150	550	600	General Electric	M
150	220/440	600	General Electric	M
150	220/440	720	General Electric	M
100	440/220	600	General Electric	M
100	2200	720	General Electric	M
100	440/220	720	General Electric	M
100	550	720	General Electric	M
100	550	600	General Electric	M
75	220/440	900	General Electric	M
75	220/440	514	General Electric	M
75	550	900	General Electric	M
75	2200/440	720	General Electric	M
60	550	900	General Electric	M
55	440/220	514	General Electric	M
50	440/220	514	General Electric	M
50	550	900	General Electric	M
50	440/220	720	General Electric	M
50	440/220	900	General Electric	M
35	440/220	900	General Electric	M
35	550	900	General Electric	M
20	220/440	720	Westinghouse	CW
20	220/440	900	General Electric	M
15	220/440	720	General Electric	M

DIRECT CURRENT MOTORS

175	115	575	Crocker-Wheeler	Interpole
75	230	700	Westinghouse	S
75	115	400	Crocker-Wheeler	D
60	220	750	Westinghouse	S
55	115	845	General Electric	CLB
50	115	750	Westinghouse	SK
50	220	525	Westinghouse	S
35	550	825	General Electric	DLC
30	220	575	Westinghouse	S
30	230	1150	General Electric	RC
25	230	750	Crocker-Wheeler	I
25	230	1150	General Electric	RC

Squirrel Cage—3-phase, 60-Cycle Motors

150	2200/440	720	General Electric	K
125	2200/440	720	General Electric	K
100	440/220	720	General Electric	K
75	440/220	600	General Electric	K
75	440/220	720	General Electric	K
60	440/220	720	General Electric	KT
50	440/220	900	General Electric	K
50	220/440	1200	General Electric	K
40	440/220	900	General Electric	KT
35	440/220	600	General Electric	K
35	550	900	General Electric	K
35	220/440	900	General Electric	K
30	220/440	1200	General Electric	KT
25	440/220	900	General Electric	KT
25	220/440	720	General Electric	K
20	220/440	900	General Electric	K
15	220/440	900	General Electric	K

DIRECT CURRENT GENERATORS

Kw.	Volts	Speed	Make	Type
200	125	600	Crocker-Wheeler	Interpole
70	125	475	Crocker-Wheeler	D
50	125	850	Westinghouse	SK
45	125	975	General Electric	CLB
12	250	600	Westinghouse	SK
6	125	300	Westinghouse	SK

MOTOR GENERATOR SETS

1—240-kw., 250/275-v., 1200-r.p.m. General Electric Type MPC Interpole Generator coupled to Type ATI 2200/440-v., 3-ph., 60-cy. synchronous motor. NEW.

1—220-kw., 250-v., 514-r.p.m., Westinghouse D.C. Generator connected to 300-kva., 2200-volt, 3-ph., 60-cy., Westinghouse syn. motor.

1—75-kw., 125-volt, 900-r.p.m., General Electric Type DLC, Generator connected to 110-hp., 220/440-volt., 3-ph., 60-cy., General Electric Form K motor.

SYNCHRONOUS MOTORS, 3-PH., 60-CY.

300	2200	450	Elec. Mchy. 3 bgs.
242	2200	514	General Electric:ATI
200	2200	900	Westinghouse G

ALTERNATING CURRENT GENERATORS

1—192-kw., 514-r.p.m, 2300-v., 3-ph., 60-cy. Gen. Elec. Type ATB, with belted exciter.

1—150-kva., 900-r.p.m., 2300-volt, 3-ph. 60-cy. Westinghouse Type G, with belted exciter.

1—75-kw., 1200-r.p.m., 2300-v., 3-ph., 60-cy. Gen. Elec. Type ATB, with belted exciter.

TURBO-GENERATORS

2—500-kw., Westinghouse, 2300/550/440-volt, 3600-r.p.m., 3-ph., 60-cy. turbo-generators, with barometric condensers.

1—125-Kva., 240/480/550-v., 3-ph., 60-cy., 900 r.p.m., Westinghouse revolving field A.C. Generator with direct connected exciter, geared to a Westinghouse non-condensing 7200 r.p.m. turbine.

1—125-kw., Allis-Chalmers, 240-v., 3-ph., 60-cy., 3600-r.p.m., connected to Terry Steam Turbine with direct connected exciter.

1—35-kw. Westinghouse, 125/250-v., D. C., 1200 r.p.m., 3-wire, connected to 7200 r.p.m. Westinghouse geared turbine.

ENGINE GENERATOR SETS

1—75-kw., 250-125-v., 265 r.p.m., 3-wire General Electric connected to 13x12 Harrisburg Engine.

1—37½-kw., 125-volt, 300-r.p.m., Westinghouse D.C. Generator direct connected to 10x10 Harrisburg engine.

1—30-kw., 250-volt, 300 r.p.m. General Electric D.C. Generator direct connected to 10x10 Ames center crank engine.

If your requirements are not listed, write us, as we do not attempt to list our entire stock.

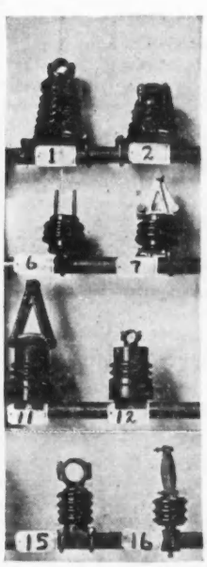
TRANSMISSION EQUIPMENT CO.

N. W. Cor. 23d St. and Washington Ave.

The material listed herein is subject to prior sale.

PHILADELPHIA, PA.

All used apparatus has been reconditioned and is unconditionally guaranteed.



DISCONNECTING SWITCHES—Indoor

Qu.	Make	Type	Amp.	Volts	Throw	Lock	Base	Conn.	Cond.	Price
3	G.E.	LG-116	300	22000	1	No	Steel	F.F.	New	$15.00
6	G.E.	LG-116	800	15000	1	With	Marble	F.B.	Used:	20.00
11	EEE	10401-Z	500	7500	1	With	Steel	F.F.	New	12.00
6	EEE	10407-Z	500	7500	2	With	Steel	F.F.	New	20.00
3	ED&M	.....	600	15000	2	With	Steel	B.B.	New	22.00
4	Delta.St.	J-1414	600	6600	2	With	Steel	F.F.	New	15.00
12	W.H.	.....	1000	3300	1	No	Slate	F.F.	New	20.00
7	W.H.	.....	600	3300	1	No.	Slate	F.F.	New	12.00
6	GD&F	.....	300	10000	2	No	Cast	F.F.	New	14.00
26	G.E.	LG-116	600	15000	1	With	Steel	F.F.	Used	15.00
3	G.E.	LG-116	600	15000	1	No	Steel	F.F.	Used	14.00
3	G.E.	LG-116	600	15000	1	With	Steel	B.B.	Used	16.00
11	G.E.	LG-116	300	15000	1	With	Steel	F.F.	Used	10.00

Outdoor

12	G.E.	LG-19	300	73000	1	With	Inverted	Used 25.00
1	G.E.	LG-19	300	73000	3P.	Gang	Operated	New 200.00

BUS BAR SUPPORTS

No. of Cut	Qu.	Type	Pipe, In.	Bus	Volts	Cond.	
1	72	GD&F	1¼	1¼-R	25000	New	$3.00
2	150	GD&F	1¼	2x3-F	6600	New	4.00
6	20	G.E.	1¼	3x¼-F	3500	New	1.50
7	8	G.E.	1¼	3x¼-F	3500	New	2.00
11	19	Franklin	1¼	4-F	7500	New	4.00
12	42	Franklin	1¼	1-R	7500	New	3.00
15	71	Delta. St.	1¼	2½-R	6600	New	1.50
16	35	Delta. St.	1¼	4-F	6600	New	1.50

POTHEADS

30—Std.Und. Cable No. 248932, 4 cond. No. 4, 3000 v. indoor, new, $8.00

OIL SWITCHES

1—Condit M-5 Subway, 200-A, 2500-v., 4 P.S.T., new.....$50.00
1—Condit PK-5 Pole Mtg., 200-A, 2500-v., 2 P.D.T., new..... 25.00

EDISON STORAGE BATTERY CELLS.

125—A-4-H, 150 amp. hour cells.....$10.00
150—A-8-H, 300-amp., hour cells..... 20.00

CURRENT TRANSFORMERS

Qu.	Make	Type	Amp.	Volt.	Cond.	Price
14	G.E.	K-28	600	15000	Used	$15.00
39	G.E.	K-28	300	15000	Used	15.00
9	G.E.	K-28	200	15000	Used	15.00
10	G.E.	K-28	150	15000	Used	15.00
6	G.E.	K-8	300	15000	Used	15.00
5	G.E.	K-8	200	15000	Used	15.00
8	G.E.	SD-20	200	7500	Used	6.00
25	G.E.	SD-20	100	7500	Used	6.00
20	G.E.	K-48	80	15000	New	30.00
10	G.E.	K-5	800	2500	Used	8.00
6	G.E.	K-6	400	2500	Used	6.00
34	G.E.	K-5	300	2500	Used	6.00
3	Westg.	S.E.	1200	2200	Used	10.00
2	Westg.	F.	1200	3300	Used	12.00
2	Westg.	F.	1000	3300	Used	12.00
4	Sangamo	K.	200	6600	Used	6.00
2	Maloney	.....	1600	.....	Used	10.00

POTENTIAL TRANSFORMERS

Qu.	Make	Type	Volts	Watts	Cond.
1	G.E.	E-12	2500/125	200	$20.00
2	G.E.	E-11	2200/100	200	20.00
2	G.E.	P.E.	2200/110/22	50	10.00
1	G.E.	Y-275	2200/110/220	100	10.00
1	G.E.	P.B.	1100/110/2200/122	50	10.00
1	G.E.	P.A.	1100/110/2200/122	50	10.00
1	G.E.	P.A.	2200/110	50	10.00
2	G.E.	H.P.A.	2300/115	150	10.00
2	G.E.	P.A.	1100/110/2200/122	200	10.00
1	G.E.	E-14	7700/13200/110	200	20.00
2	G.E.	E-11	7700/110	200	20.00
4	Westg.	20054A	2500/20/1	200	10.00
2	Westg.	150580	2500/20/1	80	10.00

CHOKE COILS—Indoor and Outdoor

22—G.E. No. 78806, Indoor, 300-amp., 15000-v.....$15.00
6—G.E. No. 78807, Indoor, 500-amp., 15000-v..... 20.00
3—G.E. No. 78912, Outdoor, 300-amp., 15000-v... 15.00

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SAVE time and money. Buy rebuilt guaranteed equipment. Just as good as new—and you get what you want when you want it. Will quote with pleasure on the smallest motor or the largest, complete plant equipment.

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Lot of 3 phase, 60 cycle, 220/440 volt Motors from 2 to 25 H.P. Will buy quick if price is right.

SPECIAL—75 H. P. General Electric, Type MT, Slip Ring Motor, 3 phase, 60 cycle, 220/440 volt, 720 r.p.m., complete with base, pulley drum controller and starting resistance.

Price—f. o. b., Philadelphia—$750.00

Hundreds of Other Motors and Generators.

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A.C. and D.C. Motors.
Generators
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Pittsburgh, Penna.

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A. C. UNITS

250 kw. G. E. 3-60-2300 volt, Alt., dir. con. 19x20 Russell 4-valve Engine, 4 yrs. service, seen operating at Athens, Ala. **$2750** f.o.b.

75 kw. G. E. 3-60-2300 v., dir. con. Ide Ideal side crank Engine, overhauled. **$800.**

75 kw. Al. Chal. 3-60-2300 v., dir. con. Chandler-Taylor s. c. Engine, overhauled. **$800.**

POWER PLANT EQUIPMENT CO.
39-41 Cortlandt Street, New York City, N. Y.

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Generating Unit

1—125 KVA Crocker-Wheeler, 3 phase, 60 cycle, 2300 volt, 257 R.P.M., generator directly connected to 1—Watertown tandem compound engine 11x22x14. This generator has been used for 5 years, is in fine shape, and priced very low for quick sale.

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6—Pittsburgh Self-cooled Outdoor Type Transformers, 600 kva., 60 cycle, single phase, 6600-2200 volts, with 4-2½% below normal taps on high tension, 2200 volts low tension.
15—250 kva. Westinghouse Outdoor Type, 2300-460/230 volt.
12—250 kva. Allis-Chalmers Outdoor Type, 2300-230/460 volt.
3—100 kva. Westinghouse S. K. Transformers, Outdoor Type, 6600-2200/2000 volt.

Write for Catalogue showing large stock of electrical equipment.

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Old Hickory, Tennessee

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1—150 Kva. General Electric alternating current generator, 3 phase, 60 cycle, 2300 volt, 225 r.p.m., direct connected to
1—Ames side crank uniflow engine. Engine complete with throttle valve, receiver, exhaust valve and complete oiling system; generator equipped with belt driven exciter, switchboard panel and instruments.
1—120 Kva. General Electric alternating current generator, 3 phase, 60 cycle, 2300 volt, 225 r.p.m., direct connected to
1—Ames uniflow side crank engine. Engine complete with throttle valve, receiver, exhaust valve and complete oiling system; generator equipped with belt driven exciter, switchboard panel and instruments.

BOILER PLANT

2—320 hp. Heine Water Tube Boilers, 160 lb. pressure, hand fired.
Each boiler equipped with McDonough automatic feed water regulators, boiler feed pumps and feed water heater.

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We have a limited number to offer of 1 Kw., 1140 speed, D.C., 32 volt, Westinghouse type, type CD, brand new at $32.50 each. Cash with order. Dealers in new and used motors. We solicit your inquiries.

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Never used. Also 2—used about 30 days. Very big bargain.

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Primary Volts 11500 23000/40000.
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1—2000 Kw. Turbo-Generator, G. E. Co., Horizontal condensing.
1—Curtis Steam Tur., G. E. Co., Kw. 2000, R.p.m. 3600, Form G. Steam Pressure 150 lb. No. 11826.
1—Alternating Current Generator, G. E. Co., No. 636565 Type ATB. P.F. 80% Class 2-2500-3600 Form T. V. 2300. Kw. 2000. Amps. 628.
1—Curtis Turbine Governor.
1—Steam Gage, Ashcroft, 6-in. dial, 0-300 lb. Scale No. 410004-A.
1—Vacuum Gage, Ashcroft, 6-in. dia., 3-30-in. Scale No. 410032 A.
1—8-in. Emergency Throttle Valve, S & K.
1—Vacuum and Pressure Gage, Ashcroft, 6-in. dial 30-in. 0-100 lb. Scale No. 419413 A.
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1—Worthington Steam-driven dry vacuum pump, Type B. Size 10-in. x 18-in. x 10-in., No. 219114 B Steam and dry vacuum cylinders are arranged tandem.
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1—500 Kw. Turbo-Generator, Curtis, G. E. Co.
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1—Field Rheostat, D.L. 106837.
1—Frequency Indicator, G. E. Co. No. 203410.
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1—Hotwell Pump Regulating Float.
1—Special Exhaust Elbow.
1—Wheeler Rotative Dry Vacuum Pump, Size 5-in. x 12-in. x 8-in., No. 03006 with ½ pint sight feed Lubricator No. 1088004.

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Size	*Condr.*	*Volt*	*Size*	*Condr.*	*Volt*
6	2	600	10	2	5,000
2	3	600	6	1	6,600
6	1	2,500	10	6	10,000
6	1	2,500	6	1	10,000
3/0	1	2,500	6	8	10,000
6	4	4,500	3/0	1	13,200
3/0	1	4,500	3/0	1	13,200

W. C. Blair
KANSAS CITY POWER & LIGHT COMPANY
Grand Avenue at 14th Street, Kansas City, Mo.

A.C. Direct Connected Sets

1—100 kw., 240 volt, 3 phase, 60 cycle, 276 r.p.m., type TRE Ft. Wayne (GE) generator to a 13x14 left hand Erie Ball engine with generator panel.
1—125 kva., Allis-Chalmers, 2300 volt, 3 phase, 60 cycle, 225 r.p.m. generator to a 15x15 Harrisburg Fleming side crank engine with exciter and board.
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1—35 hp. Lincoln, HXJ, Interm. 220—2—60—900 r.p.m.
1—5 hp. Westing. CW, 40 deg. 220/440—3—60—1730 r.p.m.
2—3 hp. Westing. CW, 40 deg. 220/440—3—60—1730 r.p.m.
1—3 hp. G. E. MQ-732, 40 deg. 220—2—60—1140 r.p.m.
1—2 hp. G. E. MQ-140, 40 deg. 220—2—60—1620 r.p.m.

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25 kw., 125 v., 1740 r.p.m., Gen. Elec. type RC-31, coupled to 40 hp., 220/440 v., 3 ph., 60 cy., type KT Motor.
46 kw., 125 v., 850 r.p.m., Lincoln, type FT, interpole, coupled to 75 hp., 220 v. 3 ph., 60 cy., Lincoln Motor.

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1—P. & H. Controller, Type M-7556.

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1—Westinghouse Electric & Manufacturing Company Generator, 50 kw., 3 wire, 200 amp., 125-250 v., with balancing coils, speed 300 r.p.m.
Style—Serial No. 716416, direct connected to American Ball Engine, complete with switchboard instruments, less volt meter.

The above equipment is in good condition, taken out to provide room for a larger machine. Make us an offer f.o.b. Portland, Oregon.

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24—Lugs for 1,000,000 CM Cable Drilled for 11/16-in. Bolt at	.05

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175—Cooper-Hewitt with tubes, type E. C., Speed 801, 60 cycle, 110 volts.

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3—333-kva. General Electric **Transformers.**
1—Allis-Chalmers 2-wire **Generator,** 120 volt, 250 amp., direct compound wound connected by coupling to one 7x7 two-cylinder double-acting non-condensing Steam Engine.
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1,000 Kw. Gen. Electric, 2-3-60-2200.
750 Kw. Gen. Electric, 2-3-60-2300.
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250 Kw. Allis Terry, 3-60-2400.
100 Kw. Gen. Electric, 3-60-600.
250 Kw. Diehl-Kerr, 125 v. D.C. NEW.

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300 Kw. Ridgeway Set. 275 v. D. C.
240 Kw. Ridgway Set. 3-60-2200 or 550.
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75 Kw. G. E. Ide. 3-60-600.

CONVERTERS

2—1,800 Kw. Gen. Electric, 3-25-2300-600 v.
2—1,250 Kw. Gen. Electric, 3-60-4150/11,000-280 v.
1— 500 Kw. Gen. Electric, 3-60-13200/6600-240 v.
1— 200 Kw. Westinghouse, 3-60-2200-600.

M. G. SETS

400 Kw. Westinghouse Synchronous 3-60 2200-600 v.
200 Kw. Westinghouse Synchronous 3-60-2200-250 v.
150 Kw. Westinghouse Synchronous 3-60-6000-2200-250 v.

TRANSFORMERS

2—450 Kva. Pitts., 3-60-13800/460-230.
6—333 Kva. Pitts., 1-60-13800/6900/4100-2200 v.
1— 10 Kva. Pitts., 3-60-2200/220-110 v.

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7—823 HP. Stirling ASME Std., 200 lbs.—Stokers.
4—509 HP. Stirling Mass. Std., 200 lbs.—Stokers.
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20 TO 100 H. P.

Special Bargain Prices on these Two Motors

1—150 A.C. Westinghouse, Squirrel Cage, 2200 volts, 3 phase, 60 cycle, 580 speed, with compensator.
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All 3 phase, 60 Cycle, 2200 volts

25—5, 10, 15 and 20 Hp. Motors, also
3— 25-hp. G. E., Type I, Form K, 900 r.p.m.
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4— 50-hp. West., Type C, 850 r.p.m.
3— 75-hp. West., Type C, 690 r.p.m.
3— 75-hp. G. E., Type I, Form K, 900 r.p.m.
1— 75-hp. G. E. Type I, Form M, 600 r.p.m.
2—200-hp. West., Type C, 580 r.p.m.
2—225-hp. G. E., Type I, Form K, 600 r.p.m.
3—250-hp. G. E., Type I, Form K, 514 r.p.m.
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Belted generators, all sizes.
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Accessories and Fittings

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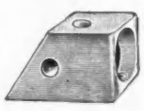

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What properties should each part possess? Which parts can be improved? How do the properties of SPAULDING-BAKELITE compare with materials you are now using?

Such an analysis may lead to valuable discoveries. No other material combines such high electrical resistance with great mechanical strength. No other material so combines the good qualities of many materials with several properties that are essentially its own.

It will pay you to thoroughly post yourself on this new material that is fast forging to the front, and replacing many of the old standbys. Send for samples and prices.

SPAULDING FIBRE COMPANY, Inc.
Wheeler St. Tonawanda, N. Y.

BRANCHES:

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484 Broome St., New York City — 15 Elkins St., Boston
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Specifications
No. 1—High Dielectric Strength
800-1500 volts per 1-1000 inch thickness.
No. 2—Great Mechanical Strength
Tensile Strength 12,000-24,000 lbs. per square inch.
No. 3—Light Weight
Specific gravity approximately 1.36.
No. 4—Chemically Inert
Unaffected by dilute acids and ordinary solvents.
No. 5—Waterproof
Less than 1% increase in weight after twenty-four hours immersion.
No. 6—Readily Machined
Can be punched, turned, threaded, drilled, tapped, sawed, etc.
No. 7—Heat Resisting
Will not soften nor distort when heated up to 250° F. indefinitely and higher temperatures for short periods.
No. 8—Low Coefficient of Expansion

SPAULDING Fibre COMPANY

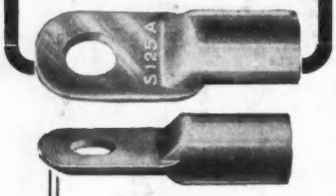
Spaulding HARD FIBRE

is a material universally used for insulation and mechanical purposes. It possesses high dielectric, tensile, shearing and compressive strength and is insoluble in any of the ordinary solvents; unaffected by oils.

Made in sheets, rods, tubes and special shapes—red, black and gray colors. Can be sawed, stamped, bent, turned, threaded, punched, drilled.

Send for samples and prices

SHERMAN
Soldering
Lugs
A Standardized
Line
of Superior Quality



A marked improvement in electrical efficiency and appearance

PATENTED
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We have perfected a complete line of soldering lugs offering decided advantages and economy to users. They are approved and listed by Underwriters' Laboratories. Highest and uniform quality at lowest cost possible because of large production and special machinery. Designs and dimensions carefully worked out to secure ratings as approved fittings. These lugs mean neat jobs. Absolutely seamless—solder can't leak out at closed ends. Made of seamless copper of exactly correct gauge.

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Battle Creek, Mich.

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CLEAN INSIDE—Made in our own open hearth furnaces, using the latest and most progressive methods to get good clean steel.

CLEAN OUTSIDE—Rolled and treated with utmost care to obtain high quality and uniformity in all respects.

RESULTS—Better magnetic performance, best die service.

MANSFIELD SHEET & TIN PLATE CO., MANSFIELD, O.

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MICA FOR ELECTRICAL AND MECHANICAL PURPOSE

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Black and Yellow
Varnished Silk, Varnished Cambric, Varnished Paper
Irr-O-Slot Insulation Flexible Varnished Tubing
Insulating Varnishes and Compounds
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Molding Materials; Laminated Sheets, Tubes and Rods; Lacquers, Varnishes and Cements.
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Continuous contact for portable machinery. Hand wound. Spring wound. Counter weight wound. Heavy Duty Plugs and Receptacles.
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We operate six great plants and maintain sales and service offices in New York, Chicago, Boston, Philadelphia, Pittsburgh, Cleveland, Milwaukee, Los Angeles, San Francisco, Detroit, Rochester, Birmingham, Denver, Seattle, Toronto, Greenville, St. Louis, Baltimore, New Haven

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In Every Commercial Form
Electrical Conductors, Conduit, Condenser Foil; Paint Powder, Etc.
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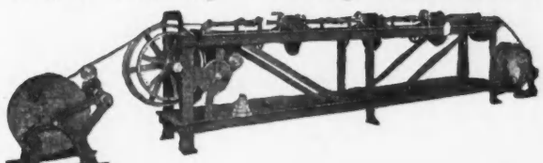
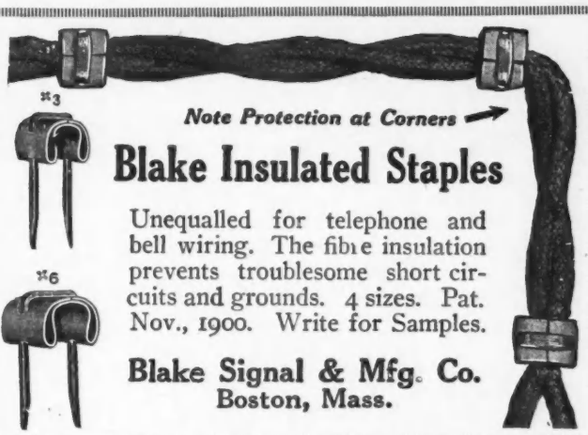


Insulation winding machine for heavy conductor (8 to 4/0 B & S)



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Unequalled for telephone and bell wiring. The fibre insulation prevents troublesome short circuits and grounds. 4 sizes. Pat. Nov., 1900. Write for Samples.

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RUBBER COVERED
SLOW BURNING
BARE COPPER WIRE

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Non-Rusting
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There is no other "copper-covered steel" or "copper-clad steel" made like COPPERWELD—by the Motten Welding Process.

IT CANNOT RUST

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You Can Use Vulcanized Fibre If It Is Continental Grade 25

For the first time in history a vulcanized fibre has been made that can be—

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Think what this means! You can save money and improve your product.

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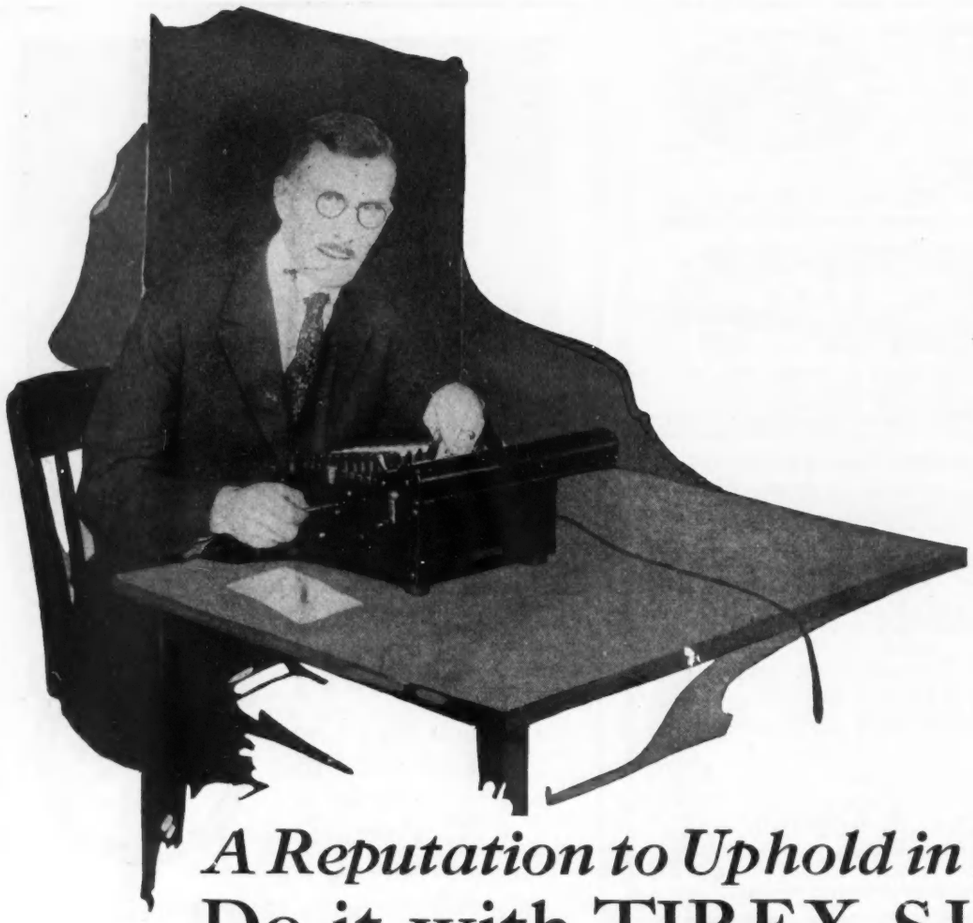
CONTINENTAL
Vulcanized
FIBRE 25

*These shapes were formed COLD from Continental Vulcanized Fibre Grade 25.



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Do it with TIREX SJ CORD

Manufacturers who have often had complaints from jobbers, dealers or agents about poor cords—cord trouble, etc., can now insure themselves in future against all such annoyances by equipping all office equipment with Tirex SJ Rubber Sheathed Cord.

This includes dictating machines, calculating machines, inter-office telephone equipment and many other electrical office appliances.

Tirex SJ Cord is made exactly like Tirex Portable Cord, the only difference being that Tirex SJ is listed only in sizes No. 16 and No. 18 and that it is lighter in weight and smaller in diameter.

And Tirex SJ always proves to be the most economical cord that can be used when its long service and unusual wearing qualities are considered.

For samples and full information mail the coupon.

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Simplex Wire & Cable Co.,
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Gentlemen:

Please send data and sample of Tirex SJ Cord.

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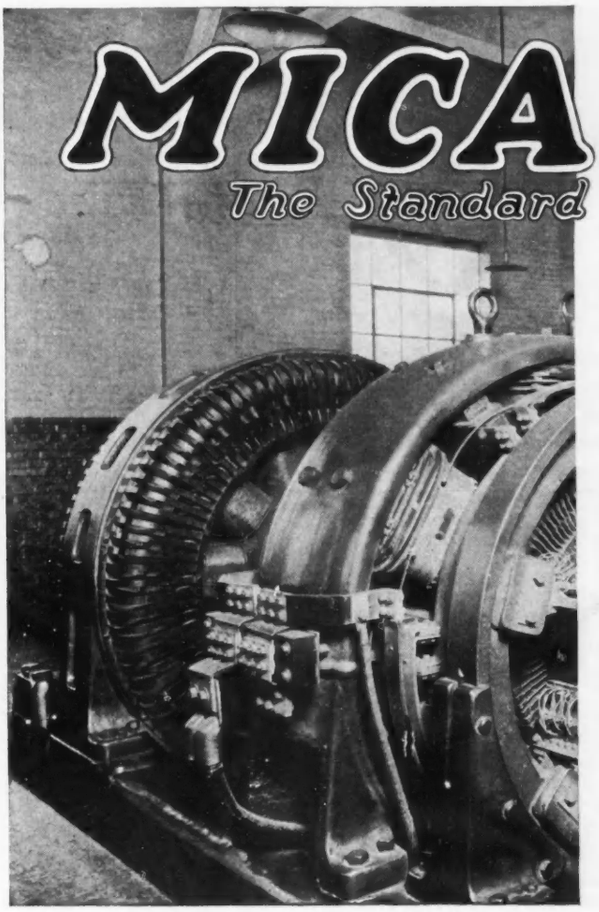
City.....State.....



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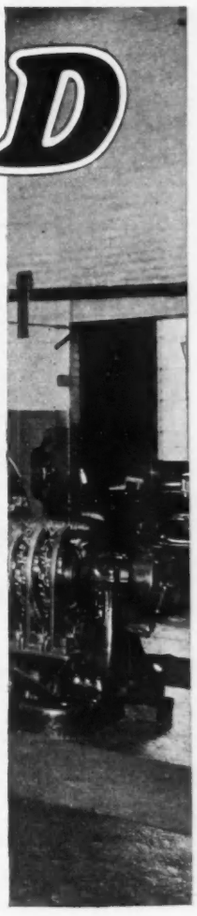
MICABOND

The Standard Mica Insulation



For more than 27 years MICABOND —the standard mica insulation — has stood as a safeguard of efficient service and as a guarantee to longer life in every type of product throughout the wide field of electricity.

No electrical product can be better than its insulation—to use any other than the best money can buy is to handicap your product from the start.

Send today for a copy of "MICABOND —the modern mica"—it will show you the way to new efficiency and new economy in the selection of dependable insulation.

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They Must Not Fail

CONTACT Points, of all things, must be absolutely reliable—so much depends upon their proper functioning. Long experience and extra care in manufacturing have made Baker Contact Points the safe, reliable units they are. They may be had of Platinum, Iridio-Platinum, Silver and Special Alloys. We shall be glad to send you detailed descriptions.

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Weatherproof Wire and Cables,
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A Superior Insulation
Strong, Accurate, Everlasting
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We maintain, at your service, a highly specialized department for the production and betterment of Electrical Steel sheets.
Submit Your Inquiries

THE NEWPORT ROLLING MILL CO.
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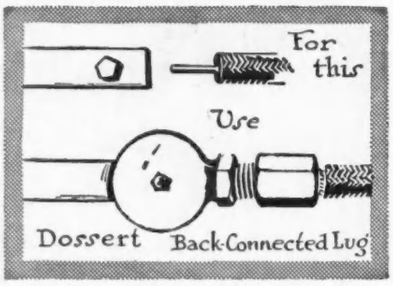

B. C. Lug

The back connected lug is another Dossert—from the large line of standardized electrical connections. All Dosserts have the tapered sleeve principle.

All are shown in the 20th Year Book. Send for your copy.

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Underground Cable Equipment and Tools

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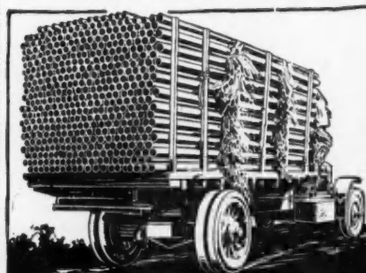

OVER thirty years' use has proved Orangeburg Fibre Conduit the most economical, safest and most reliable underground duct. Two factories assure prompt service and deliveries.

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STEEL STRUCTURES
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To Meet Every Requirement
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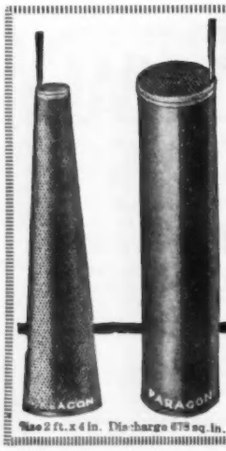

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Low Resistance. High Conductivity. Ample Capacity.

A plain, common-sense, inexpensive device accurately designed, carefully constructed of pure continuous copper throughout with no soldered or mechanical joints under ground.

Furnish adequate, dependable, durable grounding. Protect dependably valuable electric equipment from lightning, high tension crossed and other excess potential.

Complete directions for accurately and conveniently installing to insure efficiency of operation accompany every shipment.

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PORCELAIN INSULATORS
HIGH TENSION PIN-TYPE INSULATORS
WET PROCESS STRAIN INSULATORS
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Moloney Transformers

Moloney Transformers can be had in all types and sizes from the small distribution unit to the larger power sizes.

There are five Moloney factories devoted exclusively to the manufacture of transformers. Let us furnish you with complete details.

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Switches—Arresters—Fuses—Sub-Station Equipment

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Removable Burner Block, Orifice cannot be enlarged
Patented Furnace Type Burner, Greater Heat and Continuous Operation
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Flared Base for Greater Stability
Steel Tank with Bottom and Three Connections Only Brazed. Every Tank Tested to 100 lbs. Pressure
Three Thicknesses of Steel Where Greatest Wear Takes Place

This new steel torch combines all the advantages of the time tried older Dreadnaughts with a number of improvements. Built for heavier work, to give a bigger, hotter flame. New burner cleans itself automatically. Hard brass spelter solder brazes all joints. Can be used in all kinds of weather. A better "service with safety" torch at an attractive price.

Outline your Blow Torch needs by mail. No obligation.

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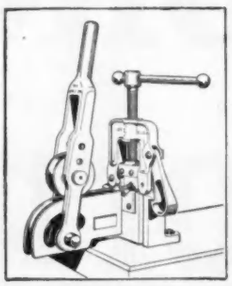
Since 1864

TIME-SAVERS

"JIFFY" PIPE BENDER VISE

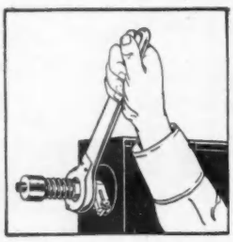
Bends ½-in. and ¾-in. conduit quickly and easily, giving at all times a positive degree of accuracy in measuring drops, angles, radii, etc.

Will not flatten, kink or split the pipe. Easily operated by any ordinary workman.



30 Day Trial if Desired

Jiffy Adjustable Cutter



Cuts holes quickly and easily, in steel boxes or slate and marble switchboard panels for conduit. Any diameter, ¾ in. to 6 in. Weight 4 lbs.

Pays Its Own Way!

Sent anywhere on 10-day trial. Money refunded if tool is not satisfactory.

"THE JIFFY LINE" circular gives full information, write for it.

PAUL W. KOCH & COMPANY

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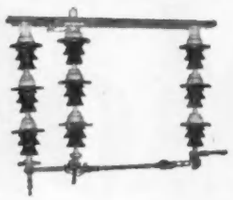

Heavy duty, group controlled Type T Disconnect Switch, for substation structures, with flexible blade and bevel gear drive.

Bulletin T.

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The Hardware makes the line Hubbard makes the Hardware

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Pole Top Switches
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in this space in all issues where larger display space is not used backs up your advertising campaign and keeps your name in the alphabetical index.

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HIGH QUALITY
LINE AND STATION EQUIPMENT

Electrical Engineers Equipment Co.
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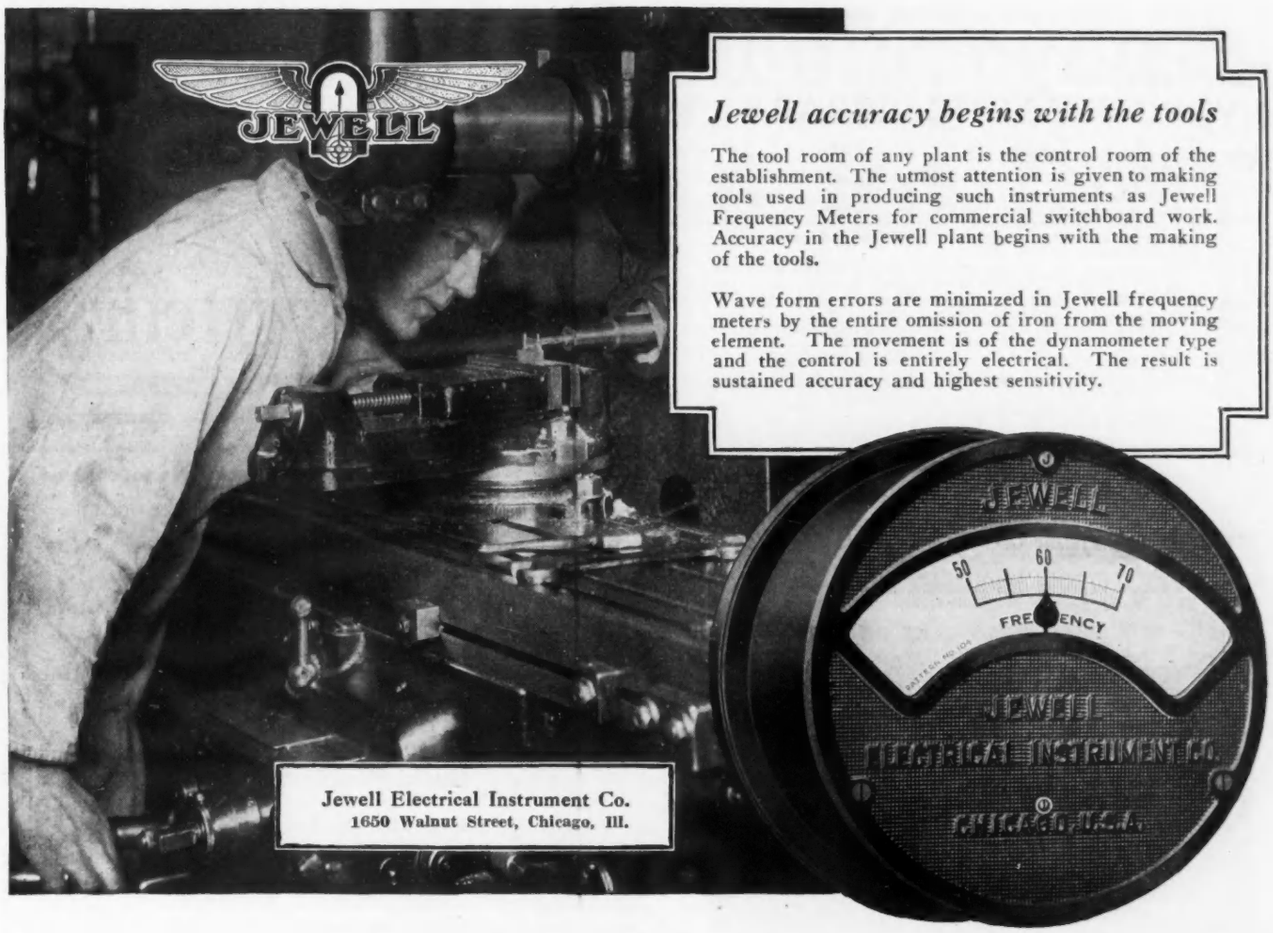

Jewell accuracy begins with the tools

The tool room of any plant is the control room of the establishment. The utmost attention is given to making tools used in producing such instruments as Jewell Frequency Meters for commercial switchboard work. Accuracy in the Jewell plant begins with the making of the tools.

Wave form errors are minimized in Jewell frequency meters by the entire omission of iron from the moving element. The movement is of the dynamometer type and the control is entirely electrical. The result is sustained accuracy and highest sensitivity.

Jewell Electrical Instrument Co.
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LANDIS & GYR METERS

The largest and most complete line of electricity meters in the world —all carefully tested and guaranteed to conform to N. E. L. A. Meter Code as to performance. Ask about them.
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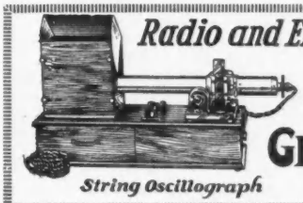

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GENERAL RADIO Co
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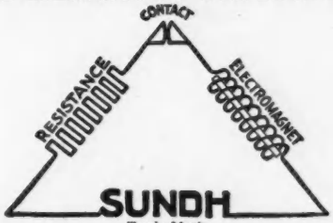

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Automatic Starters	Pressure Regulators
Circuit Breakers	Remote Switches
Float Switches	Speed Regulators
Hand Starters	Transfer Switches
Magnet Switches	Valve Control

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Campbell LYNN, MASS
AUTOMATIC ELECTRIC
TIME SWITCHES
AND
TRANSFORMERS
for Every Purpose
CAMPBELL MFG. CO. LYNN, MASS.

G&W ELECTRIC SPECIALTIES
POTHEADS ~ UNDERGROUND BOXES ~ DISTRIBUTION SPECIALTIES
They have passed the test of SERVICE
G & W ELECTRIC SPECIALTY CO.
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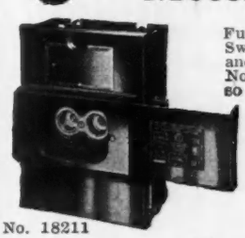
Meter Service Switch



Furnished with accessible service side fuses. Switch and fuses are both ahead of meter and both are dead when switch is opened. No branch circuit fuses in cabinet. Box is so constructed that service fuses are not accessible until switch is in "off" position. Switch cannot be thrown into contact until fuse cover is closed, thus giving full safety with cover sealed. *Described in Circular 3.*

Are you acquainted with our Standard Unit Panelboards listed in Bulletin A.

No. 18211
List $5.80 without Test Blade
List $6.30 with Test Blade
Schedule C-2
Discount

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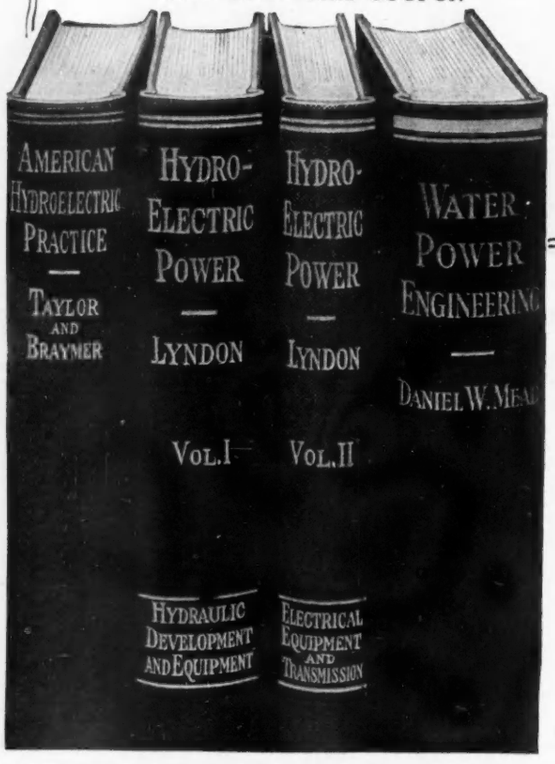

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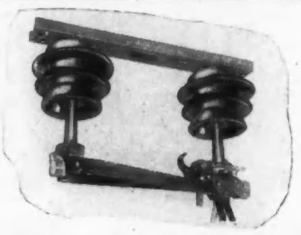

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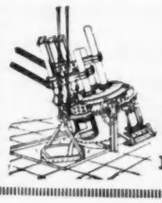

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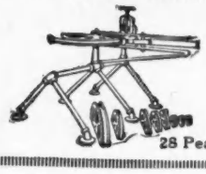

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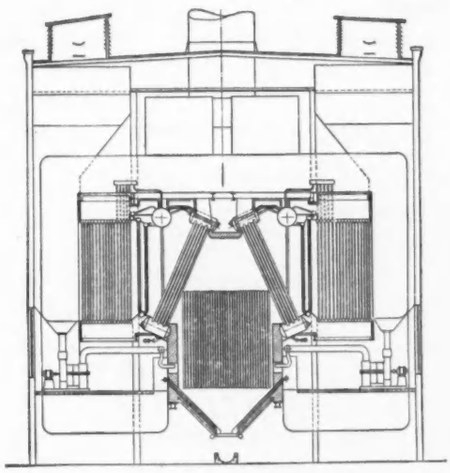

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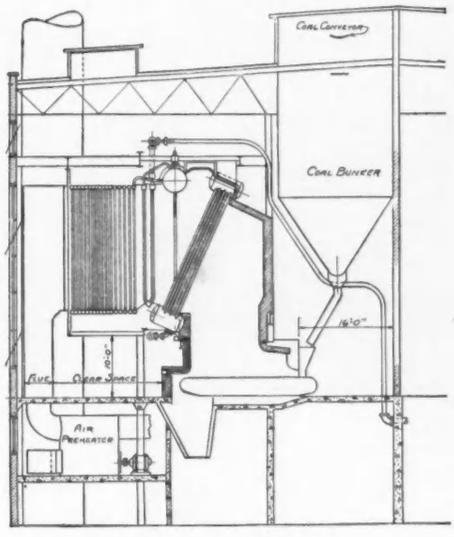

Single Pass Boiler with chain grate stoker—low headroom and narrow firing aisle.

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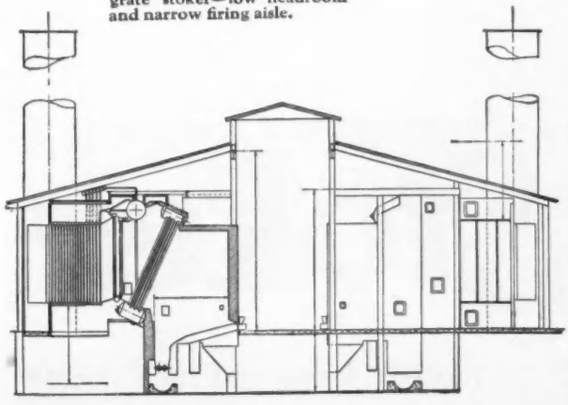

Single Pass Boiler with underfeed stoker—large furnace volume and low headroom.

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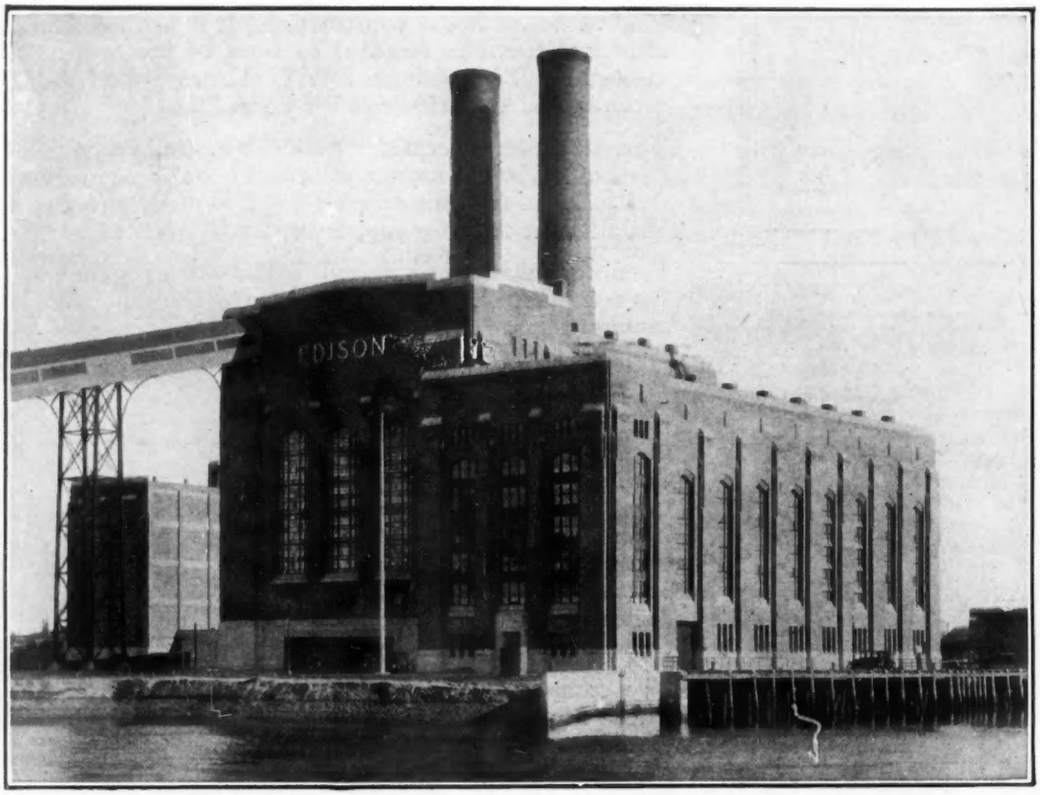

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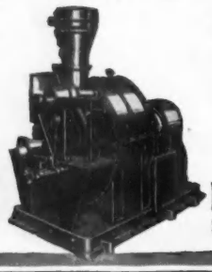

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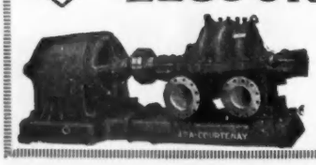

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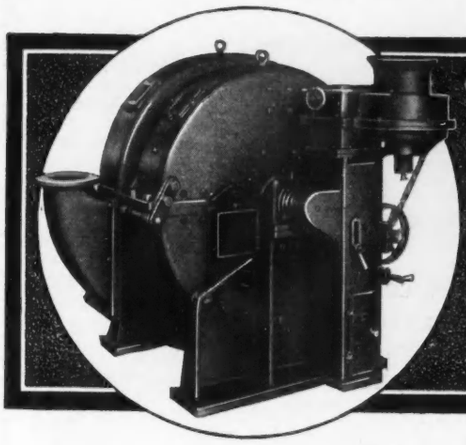

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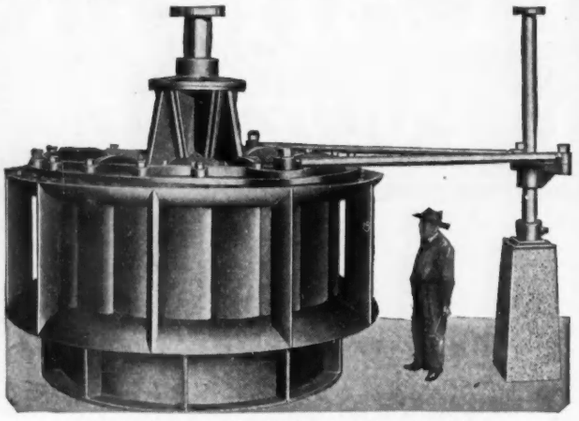

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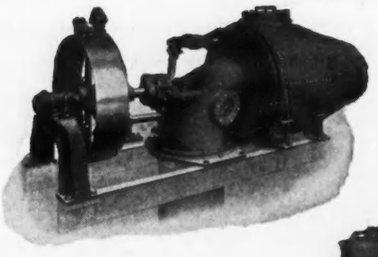

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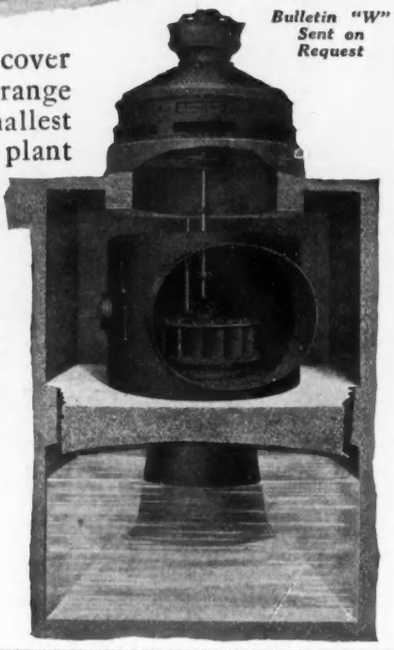

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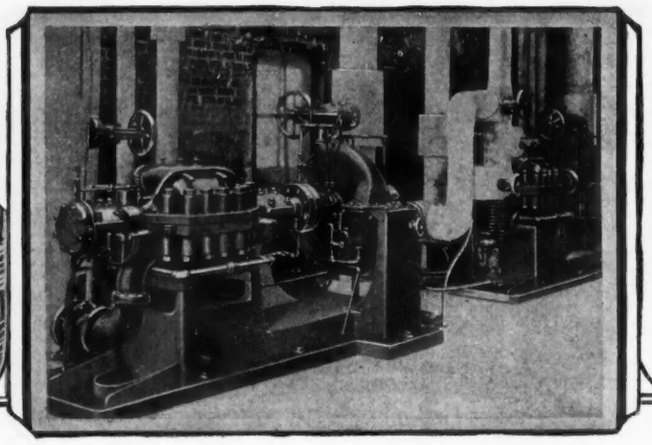

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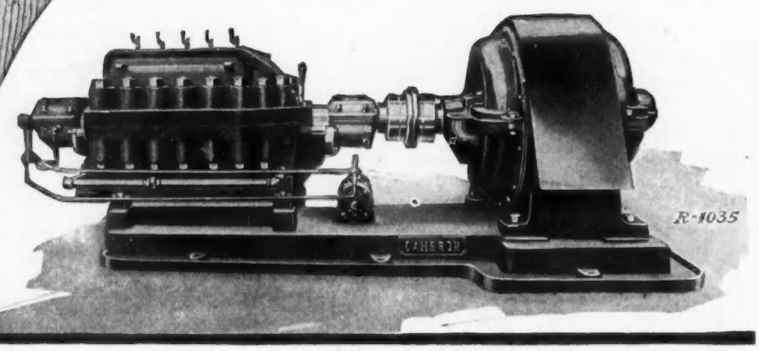

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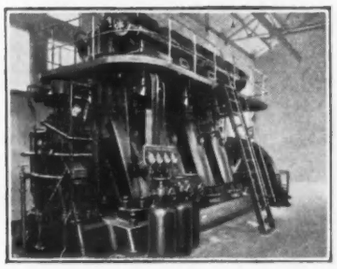
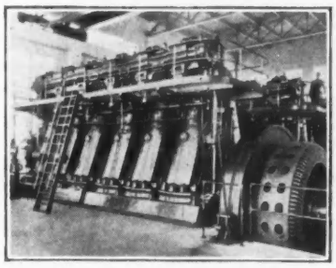


750 B. H. P. Fulton-Diesel in the Lomita Station



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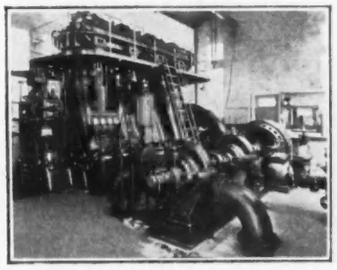

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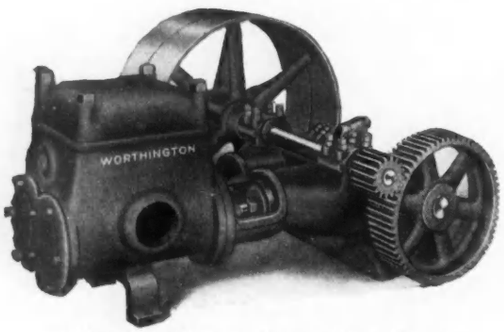

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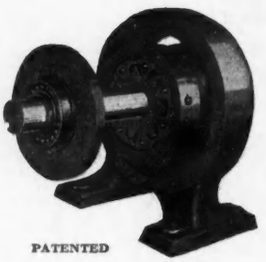

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Is today undoubtedly the most highly developed Governor for water wheels and is backed by an organization capable of meeting any special requirement or condition that may arise.

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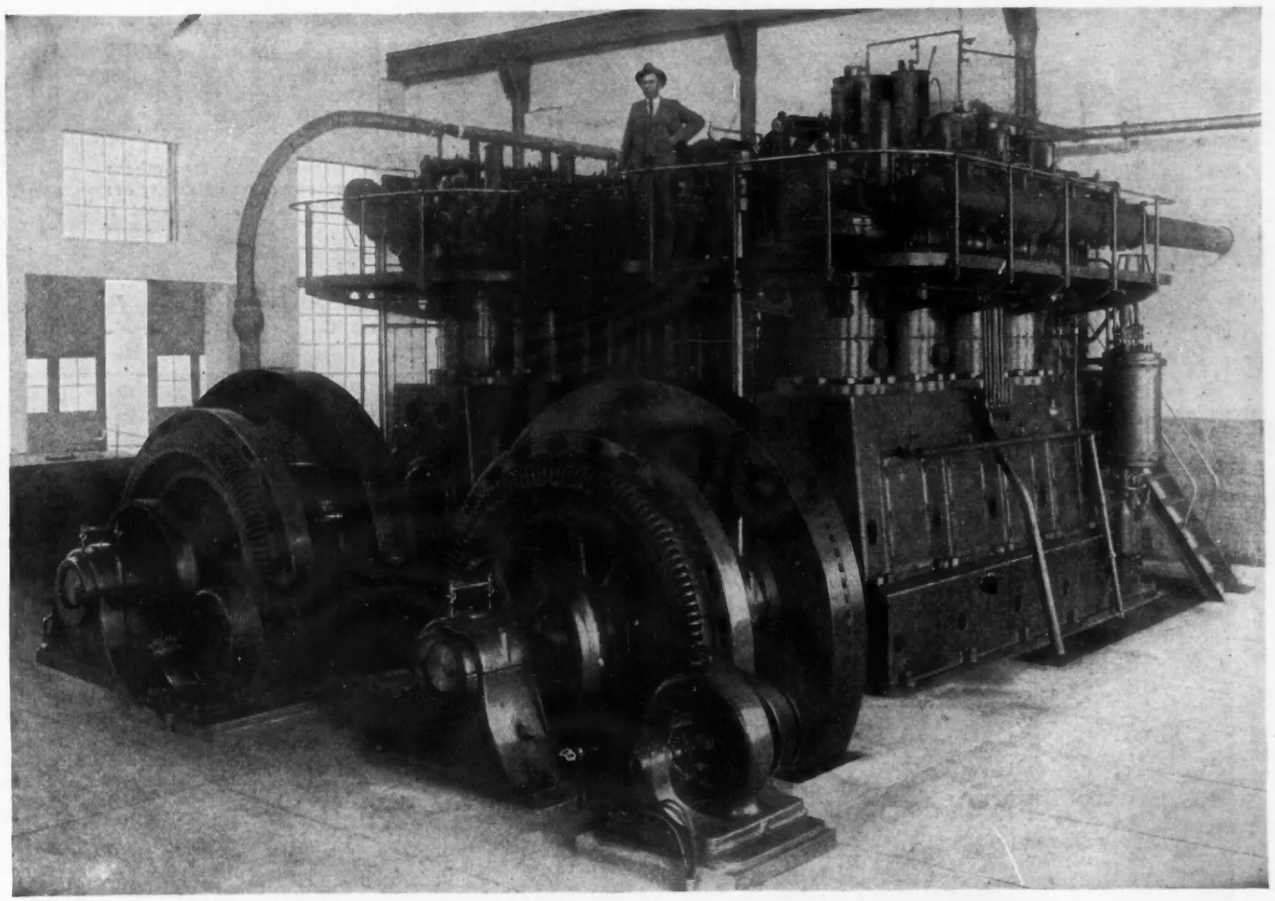

Diesel flexibility and sustained efficiency

THE fuel efficiency of a Diesel engine is independent of size and age and at least 50 per cent better in an *old* 100-hp. unit than in a *new* 50,000-hp. steam outfit. The present day high economy neither requires nor offers much opportunity for improvement. From the experimental period of 20 years ago to the present day, it has been possible to improve Diesel fuel rates only about 10 per cent by making the units 10 times as large, so replacement on account of obsolescence is a very remote possibility.

As multiple-unit Diesel operation involves no appreciable impairment of economy, a Diesel plant can be enlarged by one comparatively small unit at a time without increasing fixed charges more than justified for immediate future needs and each new investment becomes wholly profitable from the day the new unit is put into operation.

In contrast, a steam plant that provides for additional main units must be burdened with auxiliary equipment, building space, extra stack capacity, etc., far in excess of immediate needs and with an investment that must remain partly dormant perhaps for years. Later, if remodeling must be considered, the old outfit as a whole may not be well suited to the new conditions. The rapid development of and improvement in new types of steam units place a further handicap on older types, so that the inferior efficiency of the old outfit plus the additional fixed charge imposed by rearranging may prove more costly in a short time than an out-and-out new installation.

Within a very wide range, Diesel power offers far better immediate and future economy than any other power produced from fuel and heat.

Tell us your power needs and our Engineers will show you how, why and how much you can save by a Diesel installation.

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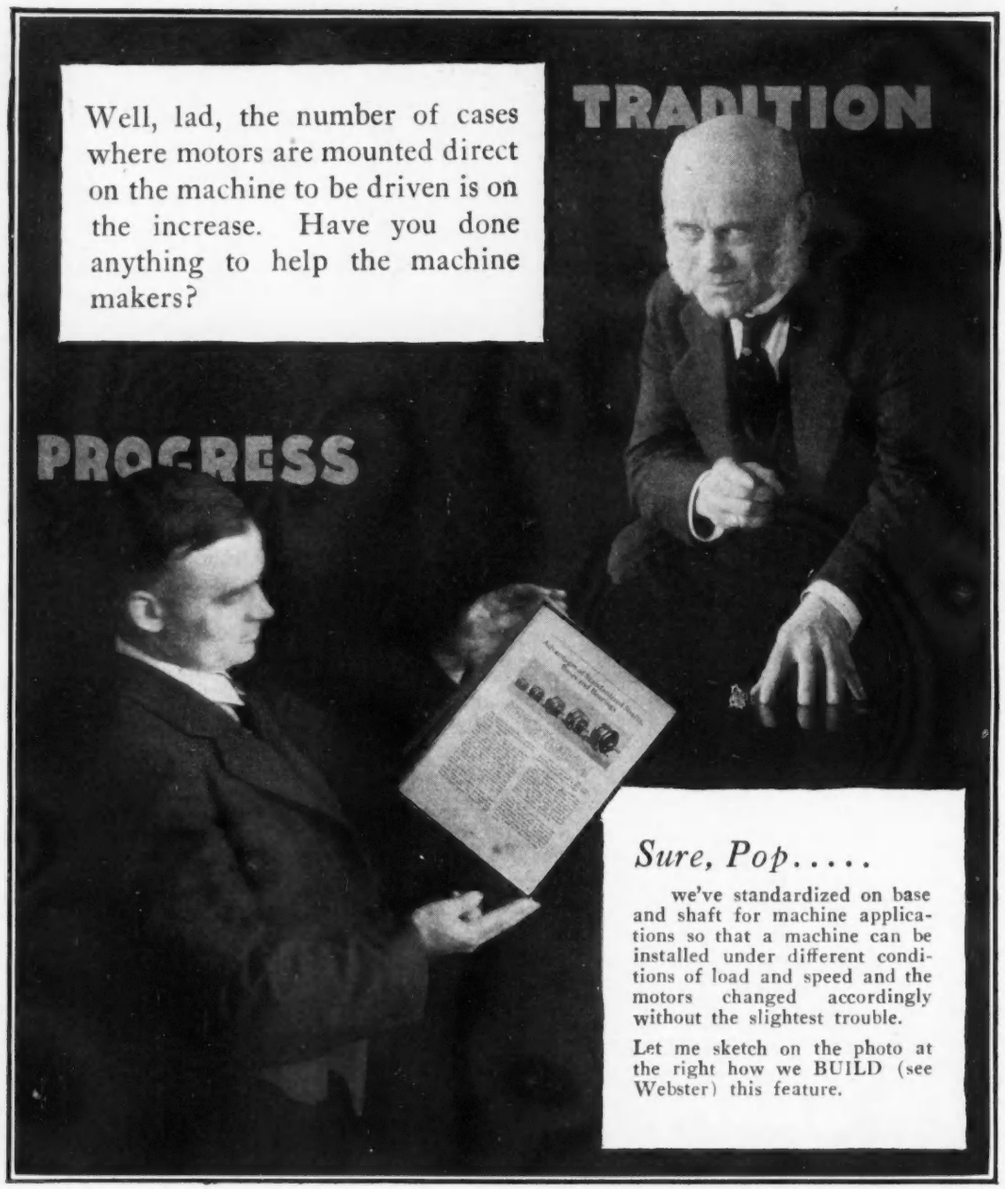
McINTOSH & SEYMOUR DIESEL ENGINES

Let's BUILD

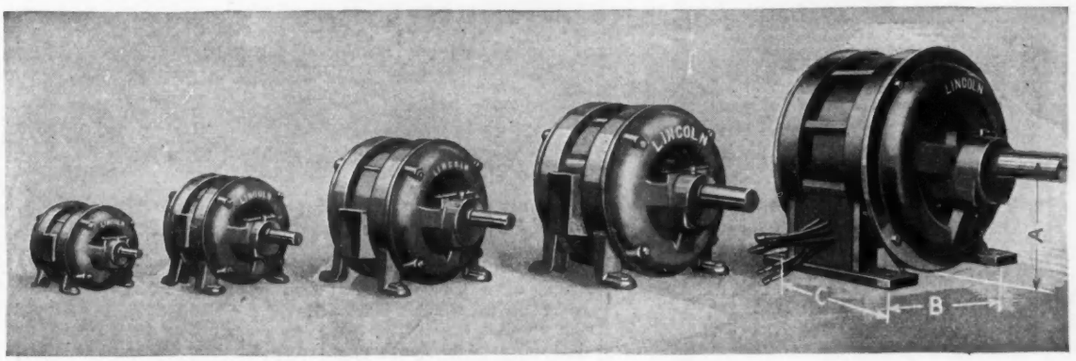
build (5)—to increase and strengthen: to increase the power and stability of: to settle or establish and preserve:
—*Webster*

What about standardization —for machine application


Well, lad, the number of cases where motors are mounted direct on the machine to be driven is on the increase. Have you done anything to help the machine makers?
TRADITION
PROGRESS
Sure, Pop.....
we've standardized on base and shaft for machine applications so that a machine can be installed under different conditions of load and speed and the motors changed accordingly without the slightest trouble.
Let me sketch on the photo at the right how we BUILD (see Webster) this feature.

LINC-

a motor! with the Stable-Arc welder



Note that in our range of motors from ½ to 150 h.p. there are only five diameters of frames.

The distance "A" from the base of the motor to the center of shaft where the machinery shaft is to be coupled does not vary a hair in these different diameters—nor does the distance "B" between the bolt holes.

We get the different power capacities by increasing the distance "C."

So you see how the same standard base can be used on the machine for a large number of motor sizes.

Fans, pumps, elevators, etc., without such motor standardization would need bases for each installation because they require different sizes of motors according to load.

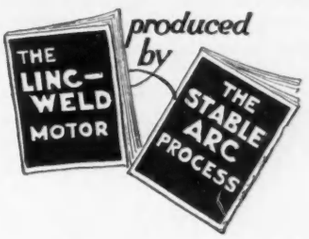
Doesn't that answer your question "What have we done for machine builders?"

And don't you think that the Stable-Arc welder, which builds this motor has also helped the machine builders to build a better product too?

The two booklets at the right tell the story in detail.

Illustrated answers

Realizing that the news value of the new process motor, as well as the process by which it is constructed, will naturally bring up many questions—two very completely illustrated volumes have been prepared thoroughly covering the subjects:



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The Stable-Arc Process Book ☐

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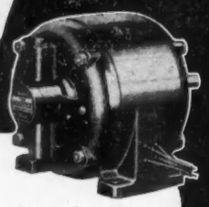

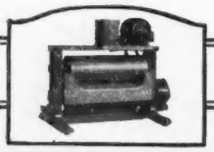

There's only one real test of quality in a motor—the *service* it gives. That MASTER MOTORS meet this test is evidenced by the fact that an ever increasing number of prominent manufacturers and jobbers are adopting them and that our customers continue to use and recommend them. Write for complete details.

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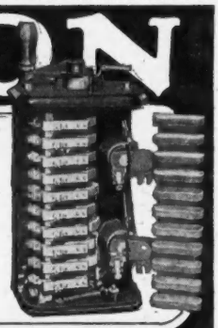

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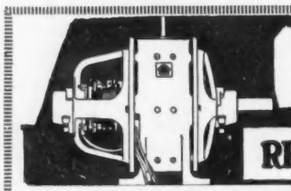

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in this space in all issues where larger display space is not used backs up your advertising campaign and keeps your name in the alphabetical index.

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HERE is an all-metal flexible coupling that never fatigues, because it does not use flexible materials of any kind — no rubber, leather, fibre, laminated steel pins, springs, grids or discs. Isn't fatigue and failure of flexible materials the basis of your coupling troubles?

FAST'S Coupling solves the problem. It will absolutely outlive the connected machines. Put it on any class of service, large or small, high or low speed, heavy duty reversing drives — the result will always be the same: No fatigue — No failure — Continuous operation!

The purely *mechanical* flexibility of Fast's Coupling definitely protects the machine bearings, adding years to the life of your equipment. It unfailingly compensates for all forms of shaft misalignment, and it eliminates all whip and crank action. All-metal, double-engagement, self-contained, it will operate continuously where dust dirt and dampness are unavoidable.

More than 8,000 coupling users are operating drives free from breakdowns formerly caused by coupling failures. They have installed Fast's. You, too, can get this operating insurance. Write today for complete illustrated catalog on Fast's Flexible Coupling.

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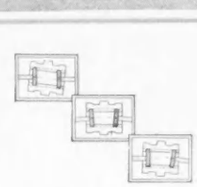
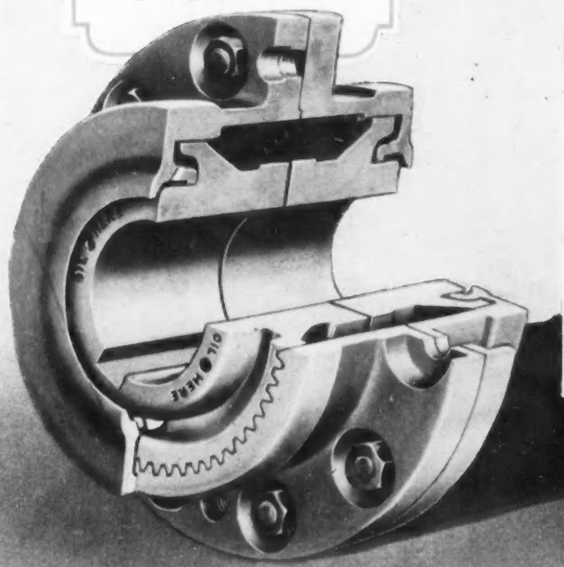


Fast's Principle of Mechanical Flexibility

TWO generated spur gears, one on each shaft end, are continually and completely meshed in oil with the internal gears of a floating sleeve. The shafts and sleeve revolve as one unit, allowing the connecting sleeve free lateral and angular play.



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No More Coupling Replacements!

HAVE you been trying to get that ideal condition in your plant? . . . You can do it with Fast's Coupling, the coupling that never fatigues.

The mechanical flexibility of Fast's puts it in a class all by itself. It makes Fast's a *permanent* piece of transmission machinery—fences it off from the "replacement parts" class. With Fast's Couplings on your drives, you have forever eliminated coupling troubles. You will know what it is to run without fear of breakdowns due to coupling failures.

Why remain face to face with expensive and troublesome coupling replacements? Install Fast's and put an end to it! Even if you have to scrap your old type couplings, it will pay you. A copy of Fast's complete catalog will quickly show you the logic of Fast's principle of mechanical flexibility. Write for it today.

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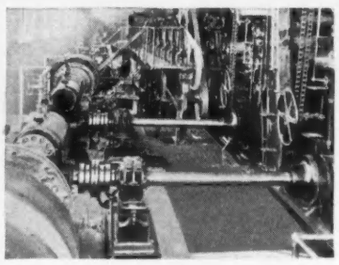

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50 h. p. at 80 r. p. m.
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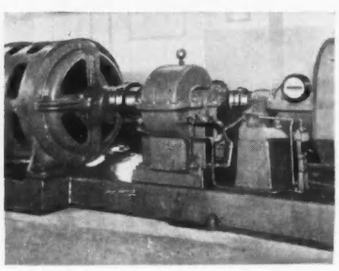

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1125 h.p. at 3740/1200 r.p.m.
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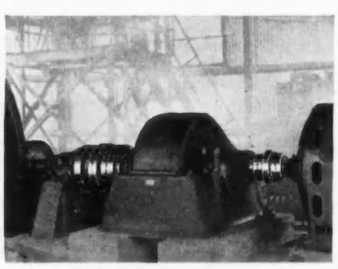

Motor-Driven Lumber Hoist
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Yosemite Lumber Co.
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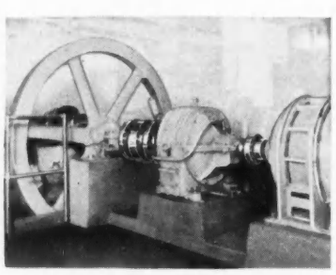

Motor-Driven Compressor
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Detroit, Michigan

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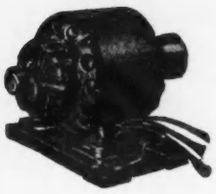

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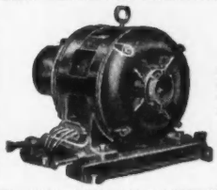

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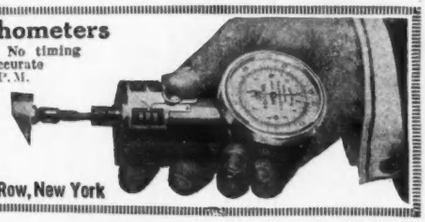

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Cutler-Hammer Mfg. Co.

Coal and Ash Handling Machinery
Combustion Engineering Corp.
Gleason & Co., J. L.

Coil Winding Tools
Electric Service Supplies Co.

Coils, Armature, Field and Magnet
Belden Mfg. Co.
Dudlo Mfg. Co.
General Electric Co.

Coils, Choke
General Electric Co.
Hi-Voltage Equip. Co.
Railway & Industrial Eng. Co.
Schweitzer & Conrad, Inc.
Westinghouse Elec. & Mfg. Co.

Compressors, Air
Ingersoll-Rand Co.

Condensation Products
Bakelite Corp.
Condensite Co. of Amer.
General Bakelite Co.
Redmanol Chem. Prod. Co.

Condensers
Worthington Pump & Machy. Corp.
Distilling
Bethlehem Shipbldg. Corp., Ltd.
Static
Westinghouse Elec. & Mfg. Co.
Steam
Allis-Chalmers Mfg. Co.
Ingersoll-Rand Co.

Condenser Tubes
American Brass Co.

Conduit
Worthington Pump & Machy. Corp.
Fibre
Fibre Conduit Co.
Johns-Manville, Inc.
Flexible, Steel
General Electric Co.
Interior
Fibre Conduit Co.
Johns-Manville, Inc.
Rigid, Steel
General Electric Co.
Underground
Johns-Manville, Inc.
Wyckoff Pipe & Creosoting Co.

Connectors and Terminals
Dossert & Co.
Electric Power Equip. Corp.
General Electric Co.
Sherman Mfg. Co., H. B.
Westinghouse Elec. & Mfg. Co.

Construction Engineering (See Directory of Engineers)

Construction Service
Hoosier Engr. Co.

Contact Rail Material
Electric Service Supplies Co.
Ohio Brass Co.

Control, Electric Valve
Cutler-Hammer Mfg. Co. (Dean)

Control Railway
Westinghouse Elec. & Mfg. Co.

Control Systems
Ward Leonard Electric Co.

Controllers
Electric Automatic
Cutler-Hammer Mfg. Co.
Ward Leonard Electric Co.
Motor
Cutler-Hammer Mfg. Co.
General Electric Co.
Industrial Controller Co.
Sundh Electric Co.
Union Elec. Mfg. Co.
Ward Leonard Electric Co.
Westinghouse Elec. & Mfg. Co.
Rheostatic
Ward Leonard Electric Co.
Speed
Ward Leonard Electric Co.

Converters
Booster
Westinghouse Elec. & Mfg. Co.
Synchronous
Westinghouse Elec. & Mfg. Co.

Conveying Machinery (Coal, Ashes, etc.)
Combustion Eng. Corp.
Gleason & Co., J. L.

Coolers
Air
Griscom-Russell Co., The
Oil
Griscom-Russell Co., The

Cord
Arc Lamp
Samson Cordage Works
Flexible
Okonite Company, The
Simplex Wire & Cable Co.
Trolley
Samson Cordage Co.

Couplings, Flexible
Bartlett-Hayward Co.

Crane Motors
General Electric Co.
Westinghouse Elec. & Mfg. Co.

Cranes
Wellman-Seaver-Morgan Co.
Traveling
Maris Bros.

Cross Arms
Graybar Electric Co.
Hubbard & Co.
Railway & Industrial Eng. Co.
Thomas & Sons Co., R.
Wyckoff Pipe & Creosoting Co.

Crucibles, Carbon
American Resistor Co.

Crushers, Coal
Furnace Engineering Co., Inc.

Cutouts
G. & W. Elec. Spec. Co.
General Electric Co.
Matthews Corp., W. N.
Metropolitan Device Corp.
Pacific Electric Mfg. Co.
Schweitzer & Conrad, Inc.
Westinghouse Elec. & Mfg. Co.

Dimmers, Theatre
Ward Leonard Electric Co.

Doors for Bus and Switch Compartments
Electrical Development & Mach. Co.
Johns-Manville, Inc.

Drills, Brick
Hubbard & Co.

Drills, Rock
Ingersoll-Rand Co.

Dynamometers
Power Specialty Co.
Sturtevant Co., B. F.

Engineers, Consulting and Contracting
(See Directory of Engineers)

Engineering, Building and Equipment
Austin Co.

Engines
Diesel
Busch-Sulzer Bros.
Fulton Iron Works
Worthington Pump & Machy. Corp.
Internal Combustion
Allis-Chalmers Mfg. Co.
Fulton Iron Works
McIntosh & Seymour Corp.
Oil
Fulton Iron Works
Ingersoll-Rand Co.
Steam
Allis-Chalmers Mfg. Co.
Ridgway Dynamo & Eng. Co.
Sturtevant Co., B. F.
Unaflow
Ridgway Dynamo & Eng. Co.

Evaporators, Water
Bethlehem Shipbldg. Corp., Ltd.
Griscom-Russell Co., The

Fan Motors
Century Electric Co.
General Electric Co.
Graybar Electric Co.
Westinghouse Elec. & Mfg. Co.

Fans
Exhaust and Ventilating
Century Electric Co.
General Electric Co.
Sturtevant Co., B. F.
Westinghouse Elec. & Mfg. Co.
Turbine Driven
Sturtevant Co., B. F.

Feed Water Heaters
Bethlehem Shipbldg. Corp., Ltd.
Griscom-Russell Co., The

Fibre (See Insulating Material)

Financial
Bonbright & Co.
Dillon, Read & Co.
Electric Bond & Share Co.
Ohio Power Co.

Flexible Cord
Okonite Co.
Okonite-Callender Cable Co.

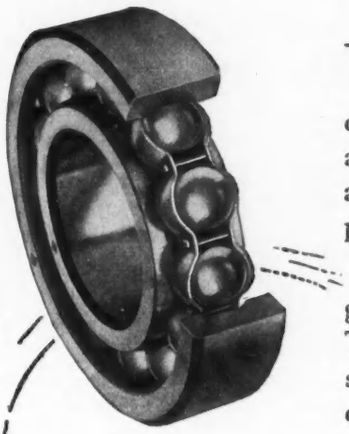
Furnaces
Electric
Combustion Engr. Corp.
Detroit Electric Furnace Co
Pittsburgh Elec. Furnace Corp.
High Temperature Heating Elements
American Resistor Co.
Pulverized Fuel
Combustion Engr. Co.
Water Cooled
Furnace Engineering Co. Inc.

Furnace Bottoms
Furnace Engineering Co., Inc.

Fuses
High Tension
Electrical Engineers' Equip. Co.
Hi-Voltage Equipment Co.
Matthews Corp., W. N.
Pacific Electric Mfg. Co.
Schweitzer & Conrad, Inc.
Westinghouse Elec. & Mfg. Co.
Renewable
Westinghouse Elec. & Mfg. Co.

Over the Pole with Byrd!

SRB BALL BEARINGS



WHAT took care of Byrd when he roared past the last outpost? What drove him on towards the North Pole—around it—and back? What kept him high and safe above a frozen, lifeless waste? The units and parts that made up his plane!

To each fell a particular function—more gruelling than the worst ordinary service. To each was given a task that couldn't be slighted or shirked—because the failure of one spread failure to the others!

SRB Annular Ball Bearings in the powerful Wright Whirlwind Engines were of those parts that had that mighty reserve for the strain—stamina for the finish.

It is such performances as these that may be expected of SRB Ball Bearings—where far more than average service is looked for—where a sudden stress must be absorbed by superior steels and workmanship.

SRB Ball Bearings Now Contain Forged Molybdenum Steel Balls for Even Greater Strength and Durability

STANDARD STEEL AND BEARINGS INCORPORATED

Plainville USE SRB BALL BEARINGS—*First!* —*they'll last* Connecticut

Standard
Condit Electrical Mfg. Corp.
Electrical Development & Mach. Co.
General Electric Co.
Graybar Electric Co.
Metropolitan Device Corp.
Westinghouse Elec. & Mfg. Co.

Fuswitches, Primary
Matthews Corp., W. N.

Galvanizing, Hot Dip
Cattie & Bros., J. P.
Lehigh Structural Steel Co.

Gauges, Recording
Bristol Co., The

Gearing, Silent Flexible
Morse Chain Co.

Gears
Continental Fibre Co.
General Electric Co.
Westinghouse Elec. & Mfg. Co.
Worm Reduction
De Laval Steam Turbine Co.

Generating Sets
Direct Connected
Westinghouse Elec. & Mfg. Co.
Geared
Westinghouse Elec. & Mfg. Co.
Motor
Allis-Chalmers Mfg. Co.
Burke Electric Co.
General Electric Co.
Ridgway Dynamo & Eng. Co.
Sturtevant Co., B. F.
Westinghouse Electric & Mfg. Co.
Turbine Driven
Westinghouse Elec. & Mfg. Co.

Generators
Allis-Chalmers Mfg. Co.
Electric Specialty Co.
Ridgway Dynamo & Eng. Co.
Belt Driven
Westinghouse Elec. & Mfg. Co.
Engine Driven
Westinghouse Elec. & Mfg. Co.
Waterwheel Driven
Westinghouse Elec. & Mfg. Co.

Generators, Cooler
Sturtevant Co., B. F.

Governors
Mechanical
Woodward Governor Co.
Water Wheel
Woodward Governor Co.

Grates, Furnace
Furnace Engineering Co., Inc.

Grounds, Etc.
Paragon Electric Co.

Hangers, Cable
Hubbard & Co.

Heaters for Special Purposes
Power Specialty Co.

Heating Devices
Cutler-Hammer Mfg. Co.
General Electric Co.
Graybar Electric Co.
Westinghouse Elec. & Mfg. Co.

Heating Elements, Non-Metallic Industrial & Domestic
American Resistor Co.

Heating and Ventilating Systems
Sturtevant Co., B. F.

Hoists
Steam and Electrical
Allis-Chalmers Mfg. Co.

Indicators, Speed
(See Tachometers)

Indicators, Transformer Load
Westinghouse Elec. & Mfg. Co.

Inspections & Tests
Electrical Testing Laboratories

Instrument Test Switches
Electrical Development & Mach. Co.

Instrument Transformers
General Electric Co.
Roller-Smith Co.

Instruments
Boiler Room
Bristol Co., The
General Electric Co.
Electrical
Bristol Co., The
General Electric Co.
Sangamo Electric Co.
Graphic
Bristol Co., The
General Electric Co.
Sangamo Electric Co.
Westinghouse Elec. & Mfg. Co.
Zernickow, O.
Indicating
General Electric Co.
Jewell Elec'l. Instr. Co.
Westinghouse Elec. & Mfg. Co.
Integrating
Biddle, James G.
General Electric Co.
Sangamo Electric Co.
Portable
Westinghouse Elec. & Mfg. Co.
Recording
Bristol Co., The
Junod & Co., L. H.
Landis & Gyr, Ltd.
Westinghouse Elec. & Mfg. Co.
Scientific and Testing Service
Bristol Co., The
General Electric Co.
Metropolitan Device Corp.
Westinghouse Elec. & Mfg. Co.

Insulating Machinery
American Ins. Machinery Co.

Insulating Material
Asbestos
Johns-Manville, Inc.
Cement
Condensite Co. of America
Composition Cloth & Paper
Irvington Varnish & Ins. Co.
Westinghouse Elec. & Mfg. Co.
Compounds, Paints and Varnishes
Garfield Mfg. Co.
General Electric Co.
Irvington Varnish & Ins. Co.
Packard Electric Co.
Redmanol Chem. Prod. Co.
Westinghouse Elec. & Mfg. Co.
Fibre
Continental Fibre Co.
National Vulc. Fibre Co.
Spaulding Fibre Co.
Laminated Phenolic Condensation Products
Bakelite Corp.
Condensite Co. of Amer.
Continental Fibre Co.
General Bakelite Co.
Redmanol Chem. Prod. Co.
Lava
American Lava Co.
Kirchberger Co., M.
Steward Mfg. Co., D. M.
Mica
Munsell & Co., Eugene
Mica, Micarata
Westinghouse Elec. & Mfg. Co.
Molded
Bakelite Corp.
Condensite Co. of Amer.
Cutler-Hammer Mfg. Co.
Garfield Mfg. Co.
General Bakelite Corp.
Redmanol Chem. Prod. Co.
Paper
Irvington Varnish & Ins. Co.
Silk
Irvington Varnish & Ins. Co.
Slate
Portland-Monson Slate Co.
Tape and Webbing
General Electric Co.
Okonite Co., The
Okonite-Callender Cable Co.
Packard Electric Co.
Westinghouse Elec. & Mfg. Co.
Treated Fabric and Paper
Westinghouse Elec. & Mfg. Co.
Untreated Fabric and Paper
Westinghouse Elec. & Mfg. Co.

Insulation, Electric
Bakelite Corp.
Condensite Co. of Amer.
General Bakelite Co.
Redmanol Chem. Prod. Co.
Spaulding Fibre Co.

Insulation, Molded
Bakelite Corp.

Insulator Equipment
Ohio Brass Co.
Thomas & Sons Co., R.

Insulator Pins
Hubbard & Co.
Ohio Brass Co.
Thomas & Sons, R.

Insulators
China, Porcelain and Composition
Jeffrey-Dewitt Ins. Co.
Porcelain
Canadian Porcelain Co., Ltd.
Cook Porcelain Insulator Co.
Locke Insulator Corp.
Porcelain Composition
General Porcelain Co.
Lapp Insulator Co., Inc.
Ohio Brass Co.
Thomas & Sons Co., R.
Westinghouse Elec. & Mfg. Co
Post Type
Electrical Development & Mach. Co.

Irons, Electric
Westinghouse Elec. & Mfg. Co.

Laboratories
Electrical Testing Laboratories

Lamps
Arc
General Electric Co.
Westinghouse Elec. & Mfg. Co.
Incandescent
General Electric Co.
Graybar Electric Co.
Westinghouse Elec. & Mfg. Co.
Miniature
General Electric Co.

Lamp Guards
W. N. Matthews Corp.

Lamp Replacers
Matthews Corp., W. N.

Lighting Equipment, Interior and Exterior
Westinghouse Elec. & Mfg. Co.

Lightning Arresters
Electric Power Equip. Corp.
Electric Service Supplies Co.
Electrical Engineers' Equip. Co.
General Electric Co.
Hi-Voltage Equipment Co.
Hubbard & Co.
Pacific Electric Mfg. Co.
Railway & Indus. Engr. Co.
Schweitzer & Conrad, Inc.
Westinghouse Elec. & Mfg. Co.

Lightning Arrester Resistances
American Resistor Co.

Line Material
Archbold-Brady Co.
Electric Service Supplies Co.
G & W Elec. Spec. Co.
General Electric Co.
Hubbard & Co.
Ohio Brass Co.
Westinghouse Elec. & Mfg. Co.

Linemen's Supplies & Tools
Mathias-Hart Co.

Locaters, Fault
Matthews Corp., W. N.

Locomotives, Electric
Westinghouse Elec. & Mfg. Co.

Lugs
Sherman Mfg. Co., H. B.

Machines
Pipe Bending
American Pipe Bending Machine Co.
Welding
Westinghouse Elec. & Mfg. Co.

Magnets
Dudlo Mfg. Co.

Manganin
Baker & Co., Inc.

Meters
Demand
Junod & Co., L. H.
Landis & Gyr, Ltd.
Westinghouse Elec. & Mfg. Co.
Kilovoltamperes
Junod & Co., L. H.
Landis & Gyr, Ltd.
Westinghouse Elec. & Mfg. Co.
Watthour
Junod & Co., L. H.
Landis & Gyr, Ltd.
Westinghouse Elec. & Mfg. Co.

Meter Testers
General Electric Co.
Westinghouse Elec. & Mfg. Co.

Meters, Electric & Flow
(See Instruments, Electric & Boiler Room)

Mica
Chicago Mica Co.
Mica Insulator Co.

Mining Machinery
Allis-Chalmers Mfg. Co.

Molded Insulation (See Insulation, Molded)

Molded Parts
Belden Mfg. Co.

Molding Materials
Bakelite Corp.
Condensite Co. of Amer.
General Bakelite Co.
Redmanol Chem. Prod. Co.

Motor Generators
Westinghouse Elec. & Mfg. Co.

Motor Generator Sets
Ridgway Dynamo & Eng. Co.

Motors
Allis-Chalmers Mfg. Co.
Baldor Electric Co.
Burke Elec. Co.
Century Electric Co.
Electric Specialty Co.
General Electric Co.
Graybar Electric Co.
Jeannin Electric Co.
Lincoln Electric Co.
Marble Card Elec. Co., The
Master Electric Co.
Reliance Elec. & Eng. Co.
Star Elec. Motor Co.
Sturtevant Co. B. F.
Westinghouse Elec. & Mfg. Co.
Zobell Elec. Motors Co.
Mine
Westinghouse Elec. & Mfg. Co.
Railway
Westinghouse Elec. & Mfg. Co.
Small
Westinghouse Elec. & Mfg. Co.

Motor Starters
Ward Leonard Electric Co.

Oil Burning Systems
Bethlehem Shipbldg. Corp., Ltd.
Combustion Engr. Corp.

Oil Engines (See Engines)

Oil Heaters
Bethlehem Shipbldg. Corp., Ltd.
Power Spec. Co.

Oil Pressure Governors
Lombard Governor Co.

Packing
General Electric Co.

Painting Equipment
W. N. Matthews Corp.

Panel Boards
General Electric Co.
Westinghouse Elec. & Mfg. Co.

Panels, Switchboard
Allis-Chalmers Mfg. Co.
General Electric Co.
Westinghouse Elec. & Mfg. Co.

Pavement Breakers, Pneumatic
Ingersoll-Rand Co.

Penstocks
Pelton Water Wheel Co.

Pipe
Riveted Steel
Riter-Conley Co.

Pipe Frame Fittings, Electrical
Schweitzer & Conrad, Inc.
Westinghouse Elec. & Mfg. Co.

Platinum
Baker & Co., Inc.

Plugs, Attachment
Cutler-Hammer Mfg. Co.

Plugs, Attachment
Cutler-Hammer Mfg. Co
General Electric Co.
Harvey Hubbell, Inc.

Pole Line Hardware
Electric Service Supplies Co.
Graybar Electric Co.
Hubbard & Co.
Ohio Brass Co.
Westinghouse Elec. & Mfg. Co.

Poles, Reinforcing of
Hubbard & Co.

Poles
Cedar
Bell Lumber Co.
Carney Co., B. J.
Graybar Electric Co.
Partridge Lumber Co., T. M.
Iron
Archbold-Brady Co.
Steel
Bates Steel Corp., Walter
Lehigh Structural Steel Co.
Milliken Bros. Mfg. Co.
Pacific Coast Steel Co.
Riter-Conley Co.
Truscon Steel Co.
Wood
Hubbard & Co.
Wyckoff Pipe & Creosoting Co.

Porcelain (See Insulating Material, China and Porcelain)
Westinghouse Elec. & Mfg. Co.

Potentiometers
General Electric Co.
Westinghouse Elec. & Mfg. Co.

Potheads
Electrical Development & Mach. Co.
G & W Elec. Spec. Co.

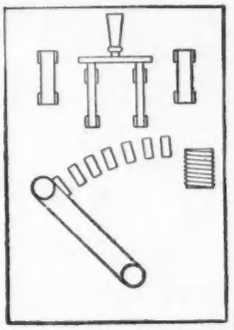
Preheaters, Air
Babcock & Wilcox Co.

Projectors, Floodlighting
Electric Service Supplies Co
Westinghouse Elec. & Mfg. Co.

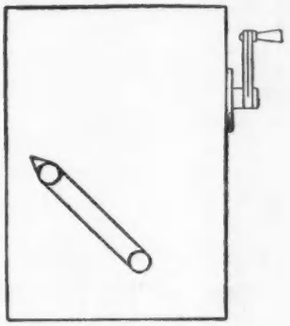
Protective Devices
Condit Electrical Mfg. Corp.
Electric Power Equip. Corp.
General Electric Co.
Metropolitan Device Corp.
Railway & Industrial Eng. Co.
Schweitzer & Conrad, Inc.
Westinghouse Elec. & Mfg. Co.

CONTROL APPARATUS

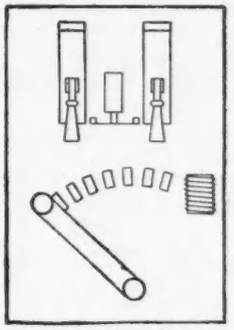
— a standardized consistent and complete line of panel type D. C. starters and controllers



Starting duty only, with line switch and fuses.

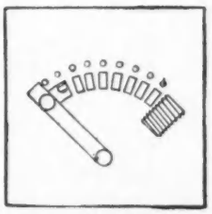


Starting duty only, enclosed.

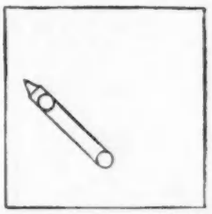


Starting duty only, with double-pole circuit-breaker.

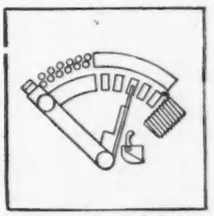
These panel types fulfill the specifications for building-equipment control apparatus issued by the Electric Power Club.



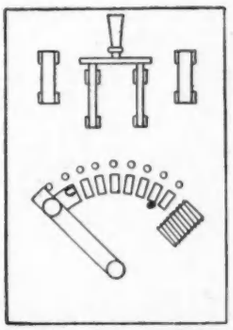
Starting duty and field control.



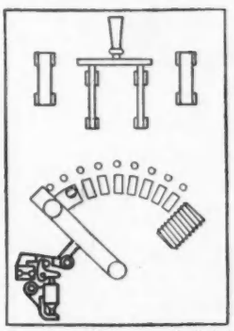
Starting duty and field control, enclosed.



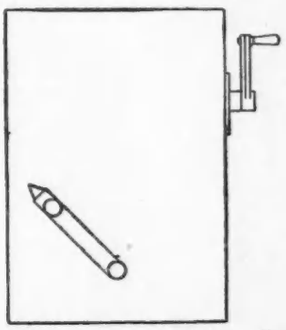
Armature and field control.



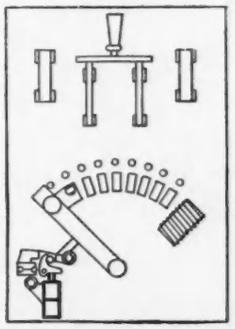
Starting duty, and field control, with switch and fuses.



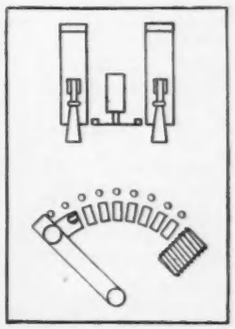
Starting duty, and field control with switch, fuses, and interlocking overload circuit-breaker.



Starting duty, and field control, enclosed.



Starting duty, and field control, with switch, fuses, and interlocking overload circuit-breaker with delayed-action attachment.



Starting duty, and field control, with double-pole circuit-breaker.

All Ward Leonard controllers are equipped with the famous Vitrohm and Ribohm resistors which meet all requirements as to permanency, constancy, accuracy, compactness, convenience and safety.

Ward Leonard Electric Company

37-41 South Street Mount Vernon, N. Y.

Atlanta—G. P. Atkinson
Baltimore—J. E. Perkins
Boston—W. W. Gaskill
Chicago—Westburg Eng. Co.
Cleveland—W. P. Ambos Co.
Detroit—C. E. Wise
Los Angeles—Bell & Slimmon
New Orleans—Electron Eng. Co., Inc.
Philadelphia—W. Miller Tompkins
Pittsburgh—W. A. Bittner Co.
San Francisco—Elec. Mat'l Co.
Seattle—T. S. Wood
St. Louis—G. W. Pieksen
Montreal—Bishop Sales Corp.
Toronto—D. M. Fraser, Ltd.
London, Eng.—W. Geipel & Co.
Melbourne and Sydney, Australia—Warburton, Franki, Ltd.

6011-2

Pulverized Fuel Equipment
Combustion Engineering Corp.
Furnace Engineering Co., Inc.
Riley Stoker Corp.

Pumping Systems, Air Lift
Ingersoll-Rand Co.

Pumps
Worthington Pump & Machy. Corp.
Boiler Feed
Bethlehem Shipbldg. Corp., Ltd.
Cameron Steam Pump Wks., A. S.
Ingersoll-Rand Co.
Lecourtenay Co.
Centrifugal
Allis-Chalmers Mfg. Co.
Bethlehem Shipbldg. Corp., Ltd.
Cameron Steam Pump Wks., A. S.
Chicago Pump Co.
De Laval Steam Turbine Co.
Ingersoll-Rand Co.
Lecourtenay Co.
Pelton Water Wheel Co.
Power
Lecourtenay Co.
Reciprocating
Allis-Chalmers Mfg. Co.
Bethlehem Shipbldg. Corp., Ltd.

Pyrometers
Bristol Co., The

Radio Apparatus
Cutler-Hammer Mfg. Co.
General Electric Co.
General Radio Co.

Rail Bonds
American Steel & Wire Co.
Ohio Brass Co.

Ranges, Electric
Westinghouse Elec. & Mfg. Co.

Rectifiers
General Electric Co.
Westinghouse Elec. & Mfg. Co.

Reels, Take Up and Pay Out
Gleason & Co., J. L.
Matthews Corp., W. N.

Refrigerators, Electric
Servel Corporation

Regulators, Feedervoltage
Westinghouse Elec. & Mfg. Co.

Relays
Westinghouse Elec. & Mfg. Co.

Repairing (See Searchlight Section)

Resistance Units
American Resistor Co.
Cutler-Hammer Mfg. Co.
General Electric Co.
Railway & Industrial Eng. Co.
Ward Leonard Electric Co.

Resistors
Westinghouse Elec. & Mfg. Co.

Resistor Units
Ward Leonard Electric Co.

Rheostats
Cutler-Hammer Mfg. Co.
General Electric Co.
Sundh Electric Co.
Westinghouse Elec. & Mfg. Co.
Battery Charging, Motor Starting, Generator
Ward Leonard Electric Co.
Motor and Generator Field
Ward Leonard Electric Co.

Rods, Brass, Copper & Bronze
American Brass Co.

Searchlights
General Electric Co.

Second-Hand Apparatus (See Searchlight Section)
Archer & Baldwin
Belyea Co., Inc.
Champion Electric Motor Co
Detroit Edison Co.
Electric Service Co., Inc., The
Ellis, A. Lee
Gregory Electric Co.
Hall & Co., Inc., Stephen
Harry De Prez
Hemphill & Co., J. L.
Hyman Michaels Co.
Kansas City Power & Light Co.
Klein & Co., Nathan
Land, L. J.
Miller-Owen Electric Co.
Nashville Ind. Corp.
National Power Machy. Co.
Nussbaum Co., V. M.
Power Machinery, Inc.
Power Plant Equip. Co.
Randle Machy. Co.
Ross Power Equip. Co.
Sachsenmaier Co., George
Scheinert Co., R.
Transmission Equip. Co.

Sheets
Brass, Copper, Bronze and Nickel Silver
American Brass Co.
Mansfield Sheet & Tin Plate Co.
Newport Rolling Mill Co.

Silent Chain Drives
Morse Chain Co.

Slack Pullers
W. N. Matthews Corp.

Slate
Electrical Specialties Corp.
Portland-Monson Slate Co.

Sockets and Receptacles
Cutler-Hammer Mfg. Co.
General Electric Co.

Solders
Westinghouse Elec. & Mfg. Co.

Soldering Flux
Benson Co., Alex. R.
Westinghouse Elec. & Mfg. Co.

Solenoids (See Coils, Armatures, Field and Magnet)

Springs
American Steel & Wire Co.

Sprockets, Silent Chain
Morse Chain Co.

Staples
American Steel & Wire Co.
Blake Signal & Mfg. Co.

Starters, Motor, Electric
Condit Electrical Mfg. Corp.
Cutler-Hammer Mfg. Co.
General Electric Co.
Industrial Controller Co.
Sundh Electric Co.
Ward Leonard Co.
Westinghouse Elec. & Mfg. Co.

Steam Specialties
Johns-Manville, Inc.
Power Specialty Co.

Steel Plate Work
Blaw-Knox Co.

Stokers
American Engr. Co.
Babcock & Wilcox Co.
Combustion Engr. Corp.
General Electric Co.
Riley Stoker Corp.
Mechanical
American Engr. Co.
Combustion Engr. Corp.
Westinghouse Elec. & Mfg. Co.

Stoves (See Ranges)

Strainers, Oil
Bethlehem Shipbldg. Corp., Ltd.

Structural Steel
Blaw-Knox Co.
Milliken Bros. Mfg. Co.

Substations, Complete Manual Automatic & Electro-Pneumatic Automatic
Westinghouse Elec. & Mfg. Co.

Sub-Stations, Outdoor
Electric Power Equip. Corp.
Electrical Engineers' Equip. Co.
General Electric Co.
Hi-Voltage Equipment Co.
Lehigh Structural Steel Co.
Railway & Industrial Eng. Co.
Schweitzer & Conrad, Inc.
Westinghouse Elec. & Mfg. Co.

Superheaters, Steam
Babcock & Wilcox Co.
Power Specialty Co.

Supplies (Electric Railway)
General Electric Co.
Graybar Electric Co.
Ohio Brass Co.
Westinghouse Elec. & Mfg. Co.

Switchboard Supplies
Electric Power Equip. Corp.
General Electric Co.
Westinghouse Elec. & Mfg. Co.

Switchboards
Allis-Chalmers Mfg. Co.
Condit Electrical Mfg. Corp.
General Electric Co.
Graybar Electric Co.
Trumbull Electric Mfg. Co.
Westinghouse Elec. & Mfg. Co.
Asbestos
Johns-Manville, Inc.

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Air Break and Pole Top
Condit Electrical Mfg. Corp.
Electric Power Equip. Corp.
Electrical Engineers' Equip. Co.
General Electric Co.
Hi-Voltage Equip. Co.
Pacific Electric Mfg. Co.
Railway & Industrial Engr. Co.
Schweitzer & Conrad, Inc.
Disconnecting
Electric Power Equip. Corp.
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Matthews Corp., W. N.
Pacific Electric Mfg. Co.
Schweitzer & Conrad, Inc.
Trumbull Electric Mfg. Co.
Westinghouse Elec. & Mfg. Co.
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Cutler-Hammer Mfg. Co.
Electric Service Supplies Co.
General Electric Co.
Ohio Brass Co.
Sundh Electric Co.
Westinghouse Elec. & Mfg. Co.
Fuse
General Electric Co.
Matthews Corp., W. N.
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Condit Electrical Mfg. Corp.
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Condit Electrical Mfg. Corp.
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Pacific Electric Mfg. Co.
Westinghouse Elec. & Mfg. Co.
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Zernickow, O.

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Belden Mfg. Co.
Dudlo Mfg. Co.
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Kerite Ins. Wire & Cable Co.
Okonite Co., The
Okonite-Callender Cable Co.
Packard Electric Co.
Phillips Wire Company
Roebling's Sons Co., J. A.
Safety Cable Co.
Simplex Wire & Cable Co.
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American Brass Co.
Underground (Cable)
American Steel & Wire Co.
Hazard Mfg. Co.
Kerite Ins. Wire & Cable Co.
Roebling Sons Co., J. A.
Simplex Wire & Cable Co.
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Okonite Co., The
Okonite-Callender Cable Co.
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The smaller towns can have the same assurance of satisfactory service as the larger cities by purchasing Allis-Chalmers tested pumping units. Our Engineers will assist you with your pumping problem if you will send us your inquiry.

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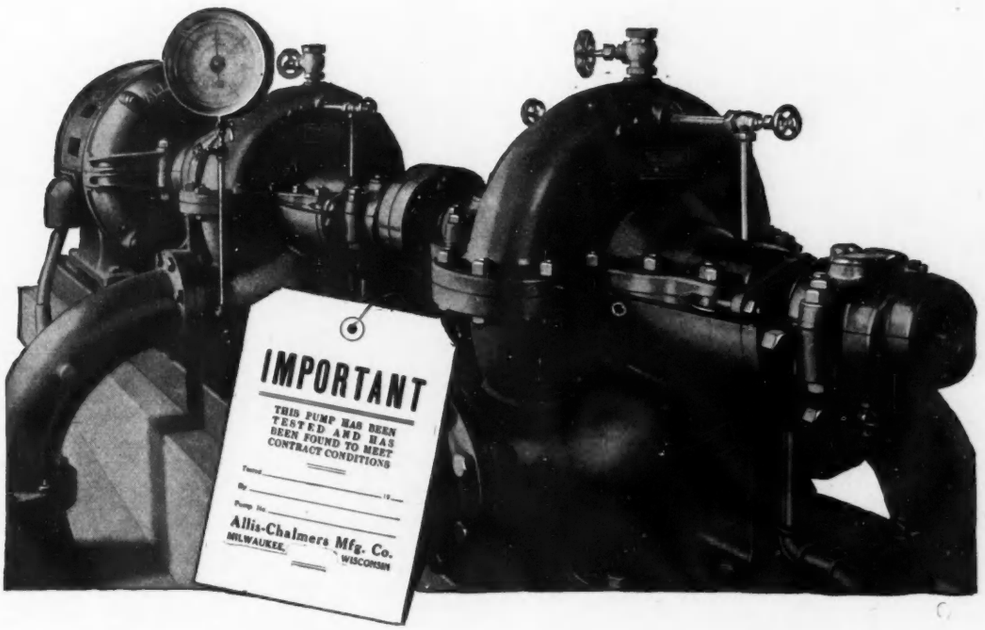
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THIS PUMP HAS BEEN TESTED AND HAS BEEN FOUND TO MEET CONTRACT CONDITIONS
Allis-Chalmers Mfg. Co.
MILWAUKEE WISCONSIN

ALLIS-CHALMERS
MILWAUKEE, WIS. U. S. A.

ALPHABETICAL INDEX TO ADVERTISEMENTS

Page

A

Aermotor Co. 54
Allis-Chalmers Mfg. Co..... 81
Allison & Co., James E..... 38
Aluminum Co. of America.... 50
Ambursen Constr. Co..... 38
American Brass Co.....30, 51
American Engineering Co....60, 61
American Insulated Wire & Cable Co..... 53
American Insulatg. Mchy. Co... 51
American Lava Corp..... 48
American Pipe Bend. Mach. Co. 58
American Resistor Co..... 4
American Steel & Wire Co..... 48
Anaconda Copper Mining Co..30, 51
Archbold-Brady Co..... 58
Archer & Baldwin, Inc..... 42
Austin Company 35
Automatic Elec. Washer Co.... 32

B

Babcock & Wilcox Co..... 64
Bakelite Corp. 50
Baker & Co., Inc..... 53
Baldor Electric Co..... 72
Barfoed & Gibson..... 38
Baricevic, L 46
Bartlett Hayward Mfg. Co..73-74
Bates Steel Corp., Walter..... 7
Battey & Kipp..... 38
Belden Mfg. Co..... 29
Bell Lumber Co..... 56
Belyea Co., Inc..... 45
Bethlehem Shipbldg. Corp., Ltd. 62
Black & Veatch 38
Blake Signal & Mfg. Co..... 51
Blaw-Knox Co..... 56
Bristol Co. 69
Burke Electric Co..... 75
Busch-Sulzer Bros. Diesel Eng. Co. 68
Business Research Corp..... 38
Byllesby 38

C

Campbell Mfg. Co..... 57
Canadian Porcelain Co., Ltd.... 55
Carney Co., B. J.....F. C.
Cattie & Bros., Jos. P..... 48
Century Electric Co.....3rd Cover
Champion Elec. Motor Co..... 45
Chance Co. 13
Cheney, Edw. J..... 38
Chicago Mica Co..... 53
Chicago Pump Co..... 64
Columbian Rope Co..... 46
Combustion Engr. Corp..... 62
Condit Elec'l Mfg. Corp..... 11
Continental Fibre Co..... 51
Cook Porcelain Ins. Corp..... 55
Cooper, Hugh H..... 38
Cope, T. J..... 54
Copperweld Steel Co..... 51
Cutler-Hammer Mfg. Co..... 72

D

Daley & Co., M. J..... 38
Danz, Wm. J..... 38
Day & Zimmermann, Inc..... 38
De Laval Steam Turbine Co.... 64
De Prez, Harry 46
Detroit Edison Co...44, 45, 46, 47
Detroit Elec. Furnace Co..... 58
Dillon, Read & Co..... 37
Directory of Engineers.....38, 39
Dossert & Co. 54
Dudlo Mfg. Co..... 48

E

Edge Moor Iron Co..... 59
Electric Bond & Share Co..... 36

Page

Electric Power Equip. Corp.... 56
Electric Service Co., Inc..... 42
Electric Service Supplies Co... 22
Electric Specialty Co..... 72
Electrical Development & Mach. Co. 54
Electrical Engrs. Equip. Co.... 56
Electrical Testing Laboratories.. 38
Electrical World 3
Ellis, A. Lee..... 47
Empire Elec. Machy. Co..... 46
Engineers' Directory 38, 39
Evans Elec. Co..... 47

F

Fargo Eng'g Co..... 38
Fibre Conduit Co..... 54
Ford, Bacon & Davis..... 38
Fort Wayne Corres. School.... 40
Fowle & Co., Frank F..... 38
Fulton Iron Works Co..... 67
Furnace Engr. Co., Inc..... 62

G

G. & W. Elec. Spec. Co..... 57
Gannett, Seelye & Fleming..... 38
Garfield Mfg. Co..... 48
General Distributing Co..... 44
General Electric Co.....16, 21, 28
General Porcelain Co..... 54
General Radio Co..... 57
Gleason & Co., J. L..... 50
Graybar Elec. Co.....15, 27
Gregory Electric Co..... 42
Griscom-Russell Co..... 31

H

Hall & Co., Stephen..... 43
Harper & Taylor 38
Harza, L. F..... 38
Hazard Mfg. Co..... 48
Hemphill & Co., Inc., J. L..... 41
Hi-Voltage Equipment Co..... 55
Hoosier Eng. Co.....20, 38
Hubbard & Co..... 56
Hyman Michaels Co..... 47

I

Imperial Porcelain Works..... 50
Industrial Controller Co..... 75
Ingersoll-Rand Co..... 66
Irvington Varnish & Ins. Co... 50
Ives & Davidson 38

J

Page

Jackson & Morland 47
Jeannin Electric Co..... 75
Jeffery-Dewitt Ins Co..... 6
Jewell Elec'l Inst. Co..... 57
Johns-Manville Inc. 54
Junod & Co., L. H..... 57

K

Kansas City Power & Lt. Co. 42, 45
Kerite Ins. Wire & Cable Co... 34

Page

Klein & Co., Nathan..... 44
Knutsen, George H..... 38
Koch Co., Paul W..... 56
Krehbiel Co..... 38
Kuhlman Electric Co..... 23

L

Landis & Gyr, Ltd..... 57
Land, L. J..... 45
Lapp Insulator Co., Inc..... 54
Lecourtenay Co. 62
Lee, Wm. S..... 38
Leffel & Co., James..... 64
Lehigh Structural Steel Co.... 18
Lincoln Electric Co.....70, 71
Lincoln, E. S..... 38
Link-Belt Co. .....B. C.
Lipe, Inc., W. C..... 68
Locke Ins., Corp..... 14

M

McClellan & Junkersfeld 38
McGraw-Hill Book Co.....36, 58
McIntosh & Seymour Corp..... 69
Mansfield Sheet & Tin Plate Co. 50
Marble-Card Electric Co..... 75
Maris Bros. 68
Massachusetts Mach. Shop, Inc. 72
Master Electric Co..... 72
Matthews Corp., W. N..... 17
Mead, Daniel W..... 39
Metropolitan Device Corp..... 2
Miller-Owen Elec. Co..... 44
Milliken Bros. Mfg. Co..... 55
Missisquoi Lime Works..... 44
Moloney Electric Co..... 55
Moore, Edw. T..... 39
Morganite Brush Co..... 75
Morse Chain Co..... 72
Mullegren, A. L..... 39
Munsell Co., Eugene 50

N

Nashville Ind. Corp.....44, 46, 47
National Power Machy. Co.... 44
National Vulc. Fibre Co..... 50
Neall, N. J..... 39
Newport Rolling Mill Co..... 53
New York Machy. Co..... 38
Nussbaum & Co., V. M..... 47

O

Ohio Brass Co.....8, 9
Ohio Power Co..... 37
Okonite-Callender Cable Co., Inc. 50
Okonite Co., The..... 50
Ophuls & Hill, Inc..... 39
Osgood, Farley 39

P

Pacific Elec. Mfg. Co..... 56
Packard Electric Co..... 12
Paragon Electric Co..... 54
Partridge Lumber Co., T. M... 54
Pelton Water Wheel Co..... 62
Phillips Wire Co..... 51
Pittsburgh Elec. Furnace Corp. 58
Pittsburgh Transformer Co..... 10

Page

Portland-Monson Slate Co..... 48
Power Machy., Inc..... 47
Power Plant Equip. Co..... 44
Power Specialty Co..... 64
Public Service Prod. Co..... 39

R

Railway & Industrial Eng. Co.. 58
Randle Machy. Co..... 47
Reed, Edgar W..... 39
Reliance Elec. & Engr. Co.... 72
Ridgway Dynamo & Engr. Co.. 62
Riley Stoker Corp..... 63
Riter-Conley Co..... 56
Robinson & Co., Dwight P..... 39
Roebling's Sons Co., John A... 53
Rosenbaum & Son, J..... 47

S

St. Vincent's Hospital..... 46
Sachsenmaier Co., George..... 45
Safety Cable Co..... 53
Samson Cordage Works..... 51
Sanderson & Porter..... 39
Sangamo Electric Co..... 26
Sargent & Lundy 39
Scheinert Co., R..... 44
Schweitzer & Conrad, Inc..... 19
Scofield Engr. Co..... 39
Searchlight Section 40, 47
Servel Corporation 33
Sherman Mfg. Co., H. B..... 50
Simplex Wire & Cable Co..... 52
Sirrine & Co., J. E..... 39
Smith Co., S. Morgan..... 64
Spaulding Fibre Co..... 49
Spooner & Merrill 39
Squire, W. J..... 39
Star Electric Motor Co..... 75
Standard Steel & Bearing Co... 77
Star Electric Motor Co..... 75
Stevens & Wood 39
Steward Mfg. Co., D. M..... 53
Sturtevant Co., B. F..... 75
Sundh Electric Co..... 57

T

Technical Service 40
Thomas & Sons Co., R..... 56
Thomas, Percy H..... 39
Tomatsuri, Masa 39
Transmission Equip. Co..... 43
Trumbull Elec. Mfg. Co..... 57
Truscon Steel Co..... 5

U

Union Elec. Mfg. Co..... 72
University Placement Bureau.. 40

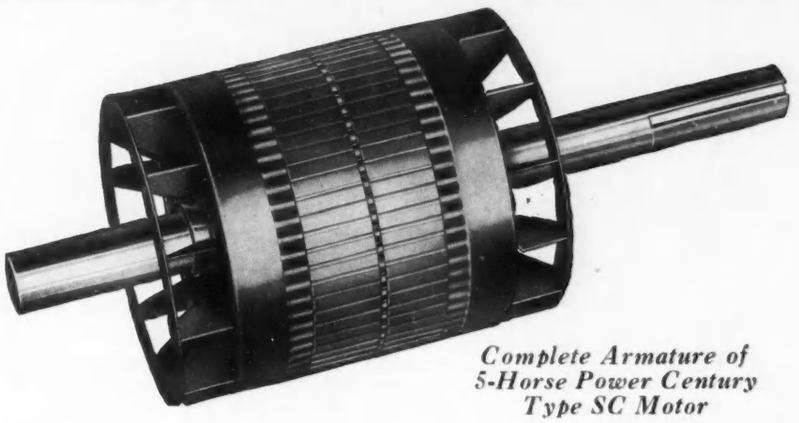
W

Wall Mfg. Supply Co., P..... 55
Ward Leonard Electric Co..... 79
Wellman-Seaver-Morgan Co. 65
Westinghouse Elec. & Mfg. Co., 24, 25
White Engrg. Corp., J. G..... 39
Wood & Weber..... 39
Woodward Governor Co..... 68
Worthington Pump & Machy. Corp. 68
Wyckoff Pipe & Creosoting Co.. 56

Z

Zernickow, O. 75
Zobell Elec. Motors Co..... 72

"They Keep a-Running"



Complete Armature of 5-Horse Power Century Type SC Motor

Rugged Armatures

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(3) In ½ horsepower and larger size motors the end rings are of slotted copper channel-section construction. They are brazed to the conductor bars over an area equal to about six times the cross sectional area of the bars.

(4) Shafts are made of special shafting steel, accurately ground and then polished on all bearing surfaces.

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Century Squirrel-cage Induction Polyphase Motors are built in all standard sizes from ¼ to 50 horsepower. Temperature rise not more than 40 deg. Centigrade.

Bulletin No. 38 gives detailed and illustrated descriptions of these motors. Write for it.

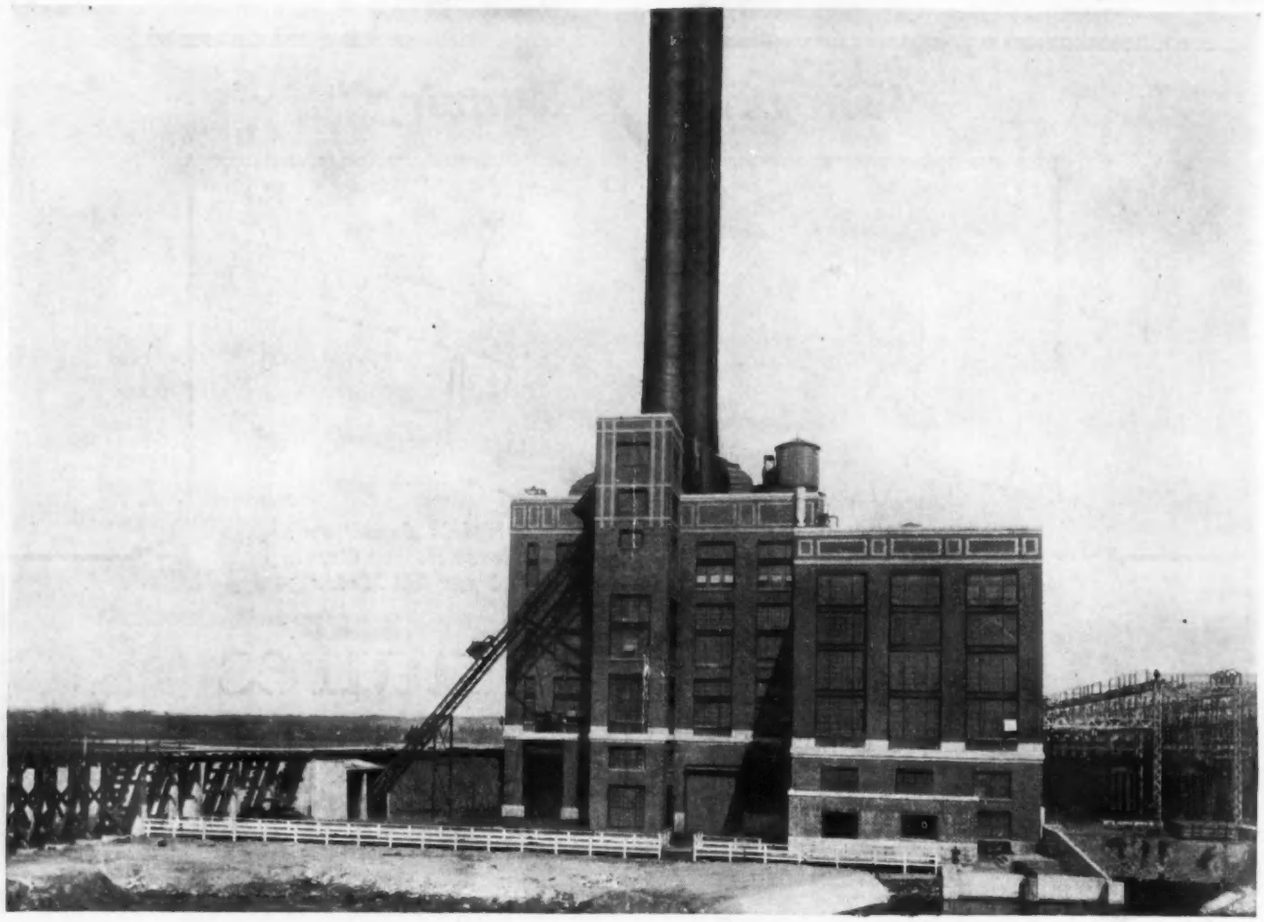
CENTURY ELECTRIC COMPANY

1806 Pine St. St. Louis, Mo.

For More Than 23 Years at St. Louis

¼ to 50 H.P. Century MOTORS ¼ to 5

SC-1



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Manufacturing complete in our own plants every practical and efficient type of coal and ashes handling equipment, we are in a position to recommend, without bias, the right type, as indicated by fifty years of experience, for each location. Thus, Link-Belt handling equipment is always perfectly coordinated with associated elements in the station, and therefore productive of the utmost economy and efficiency.

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